VOLUME XXIV NUMBER ONE

THE NATIONAL GEOGRAPHIC MAGAZINE

JANUARY, 1913

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National Geographic Society Notes

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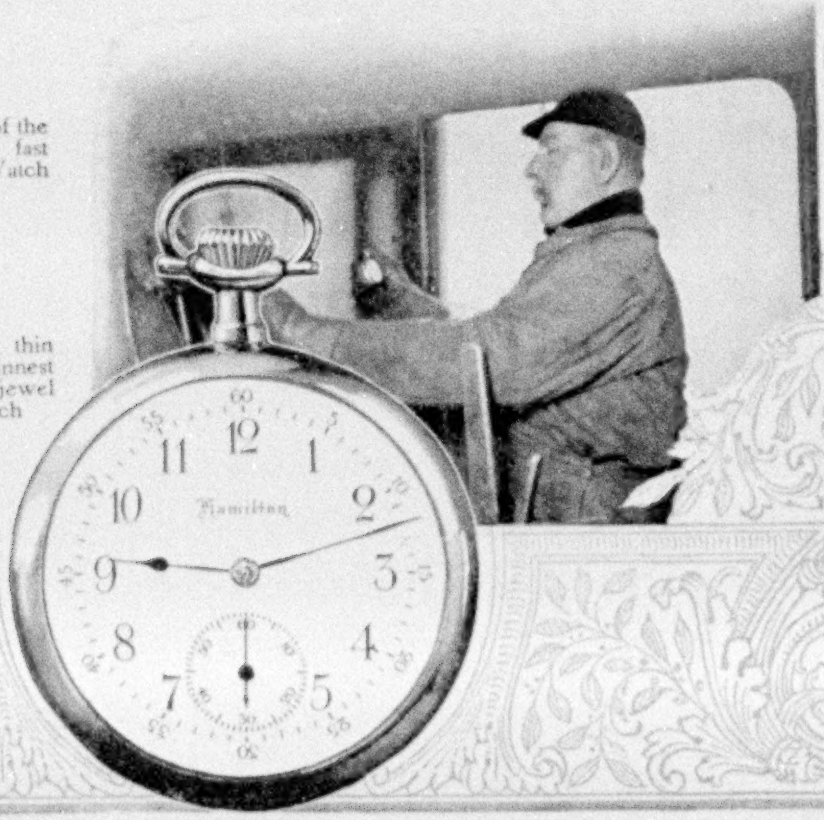

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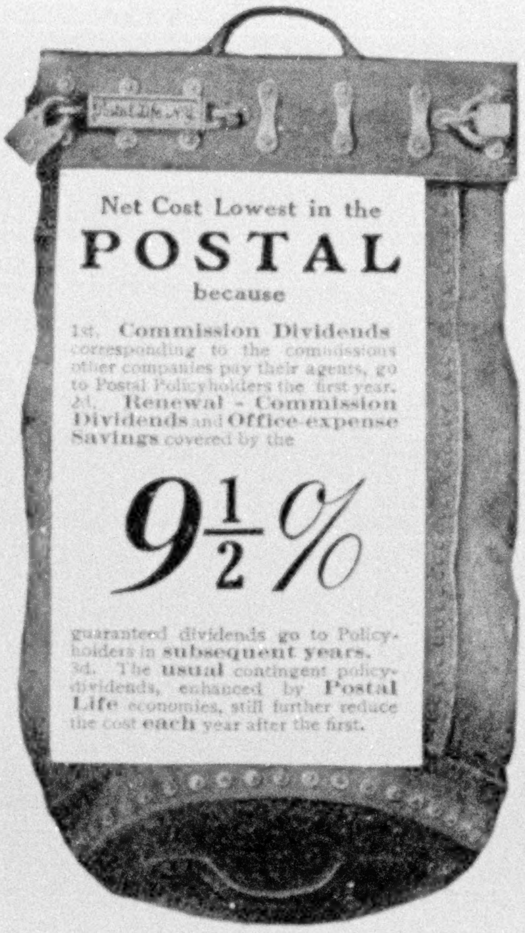

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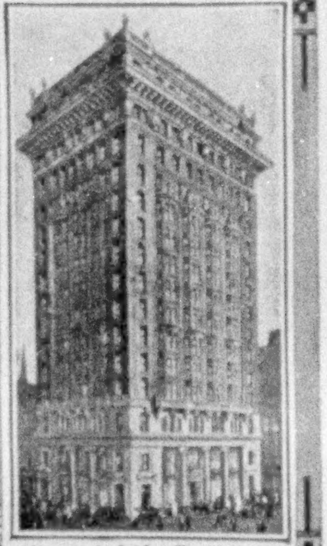

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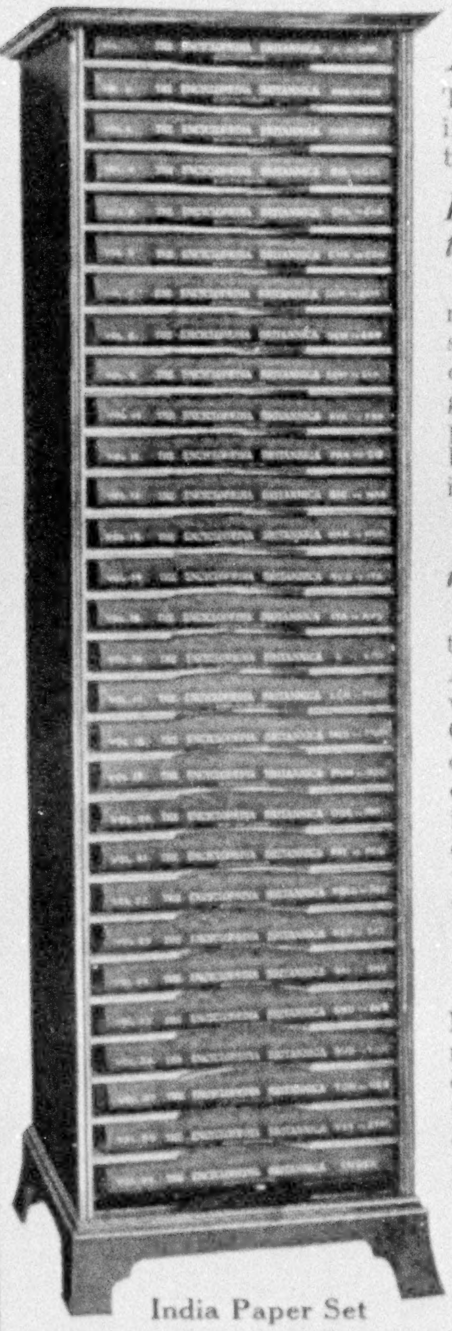

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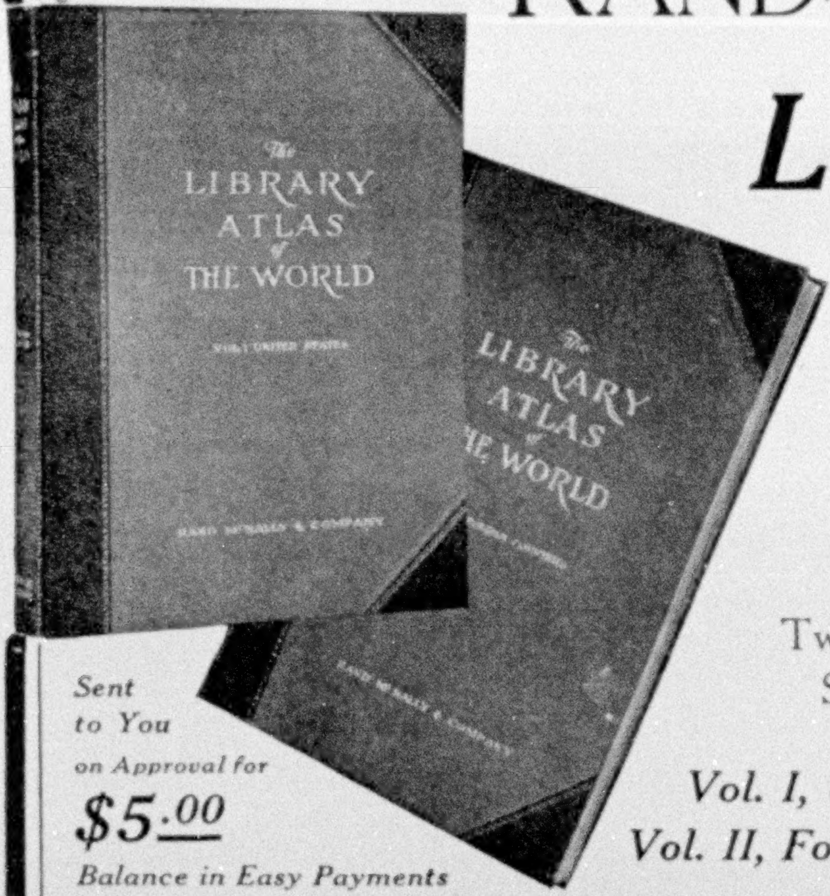

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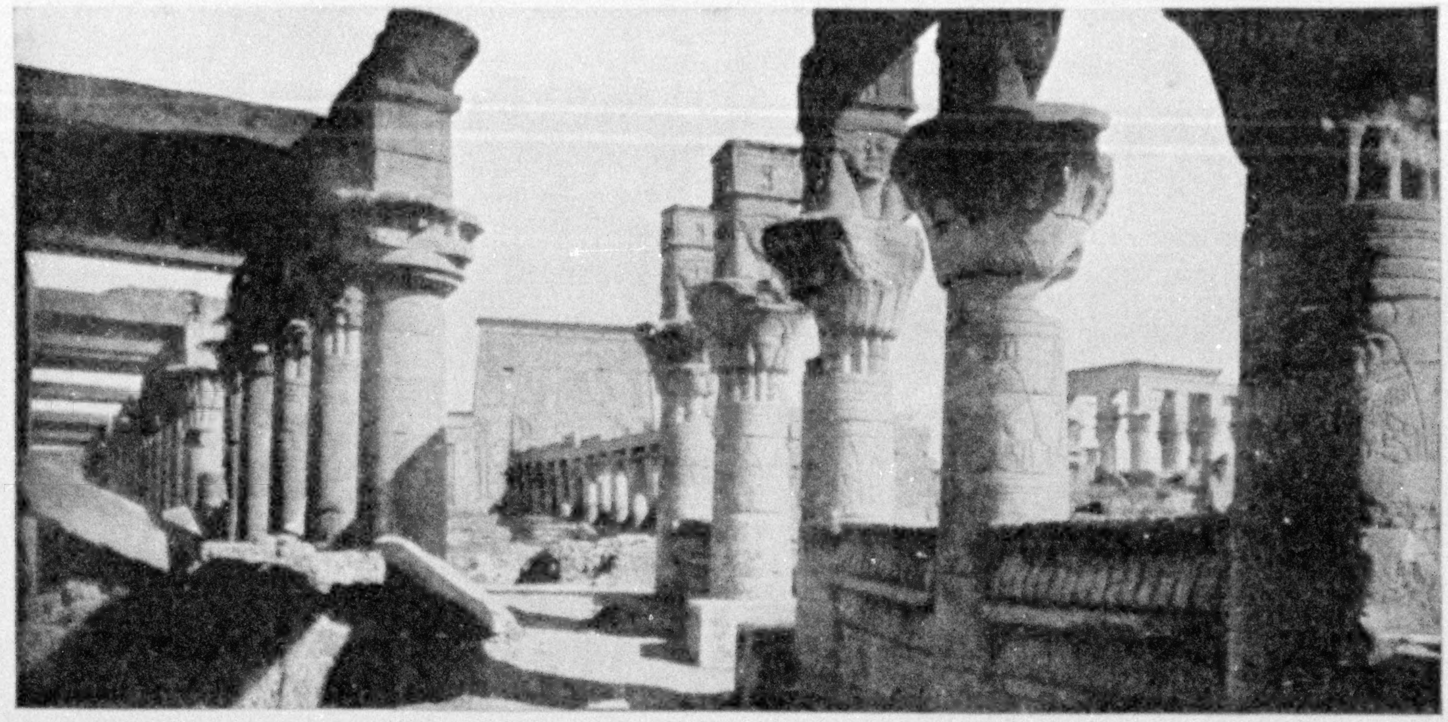

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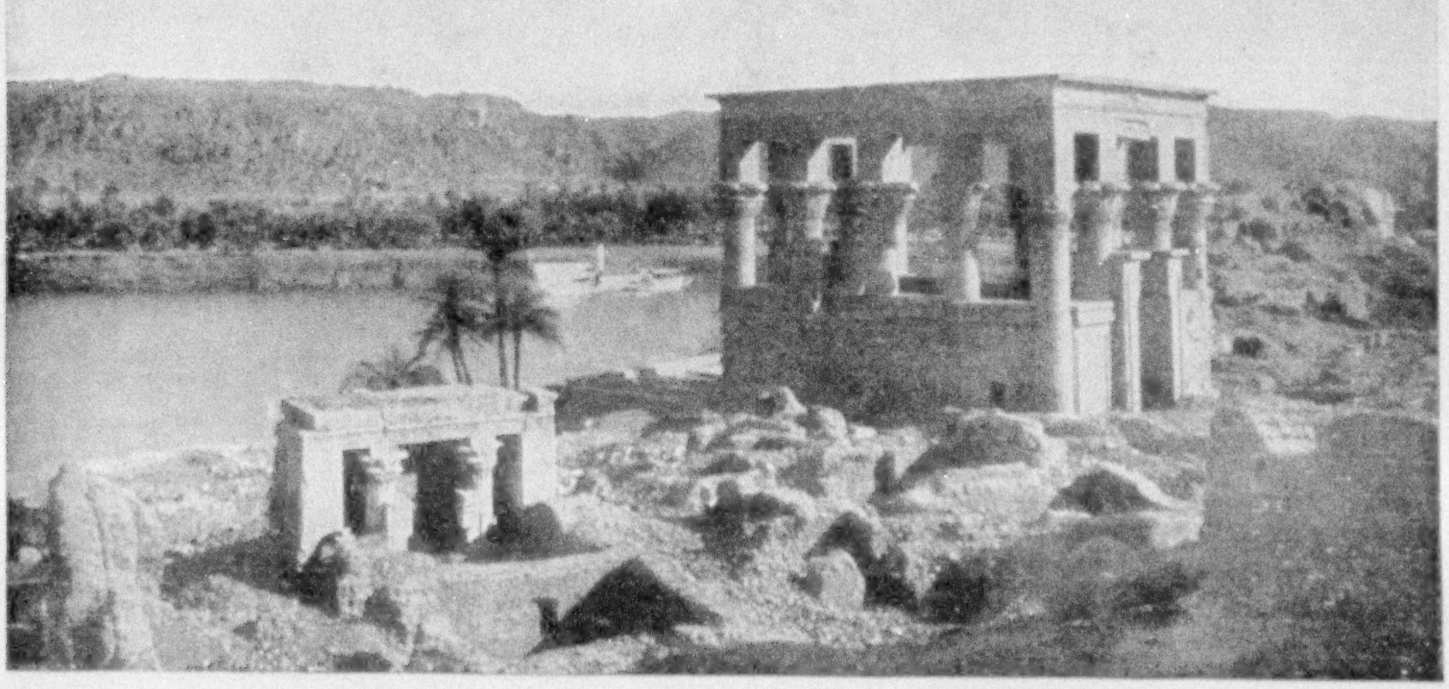

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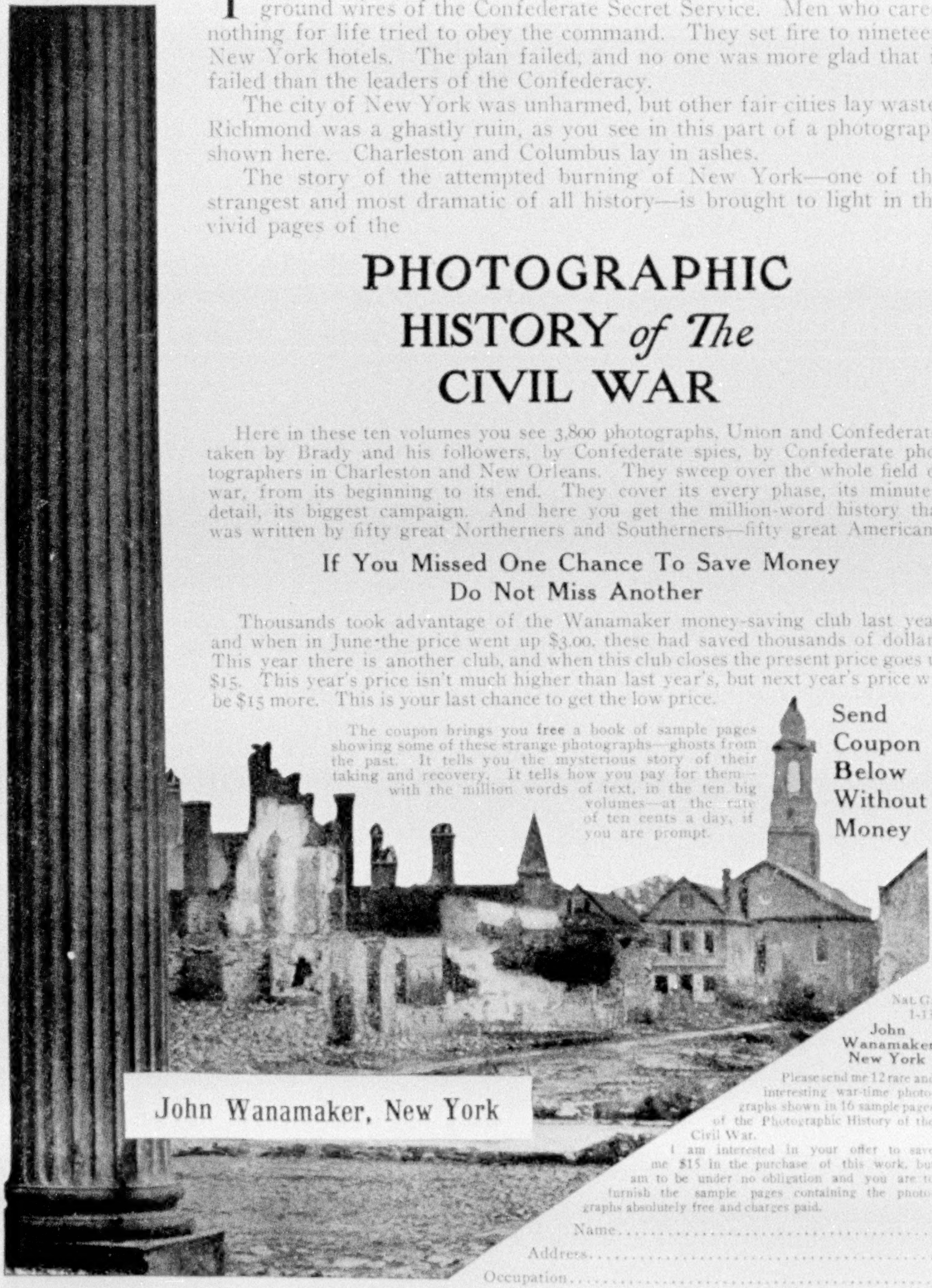

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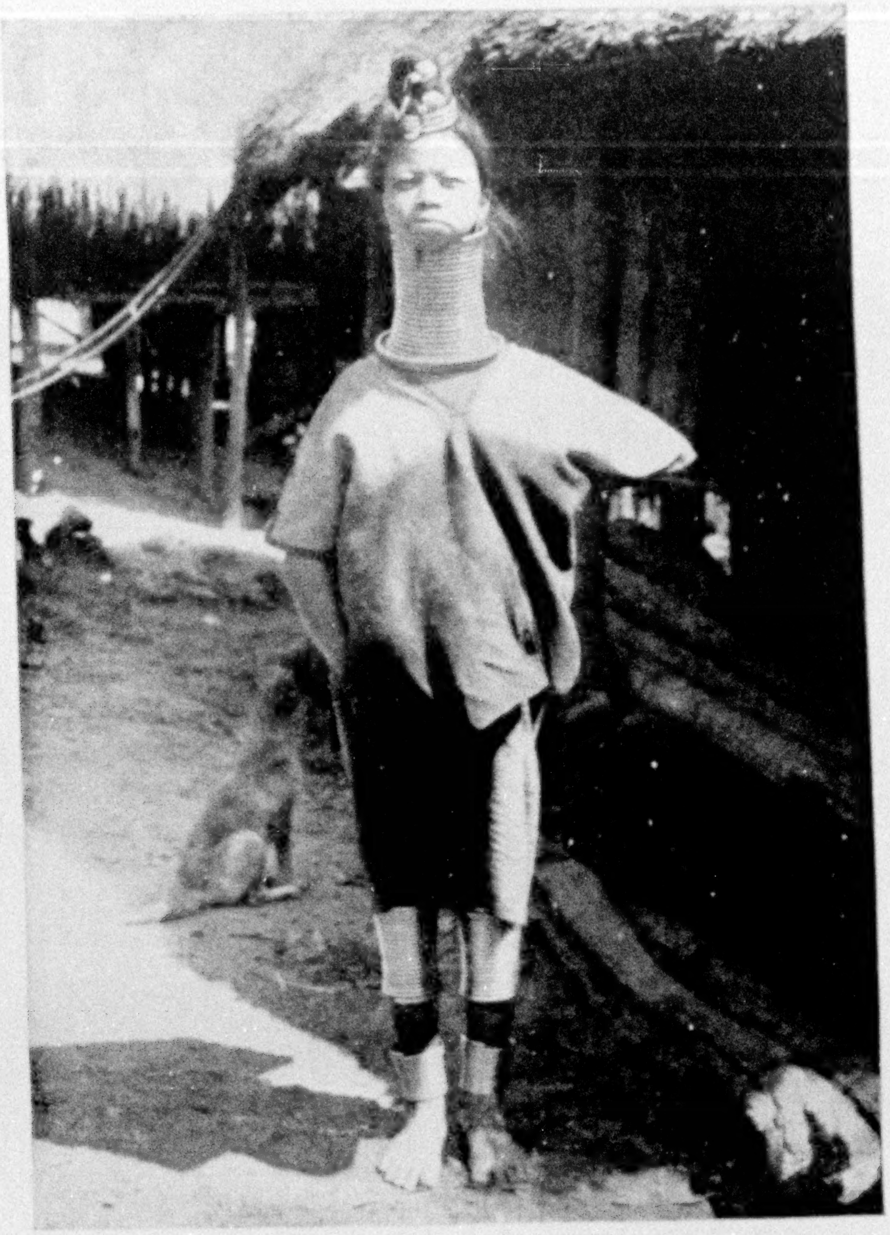

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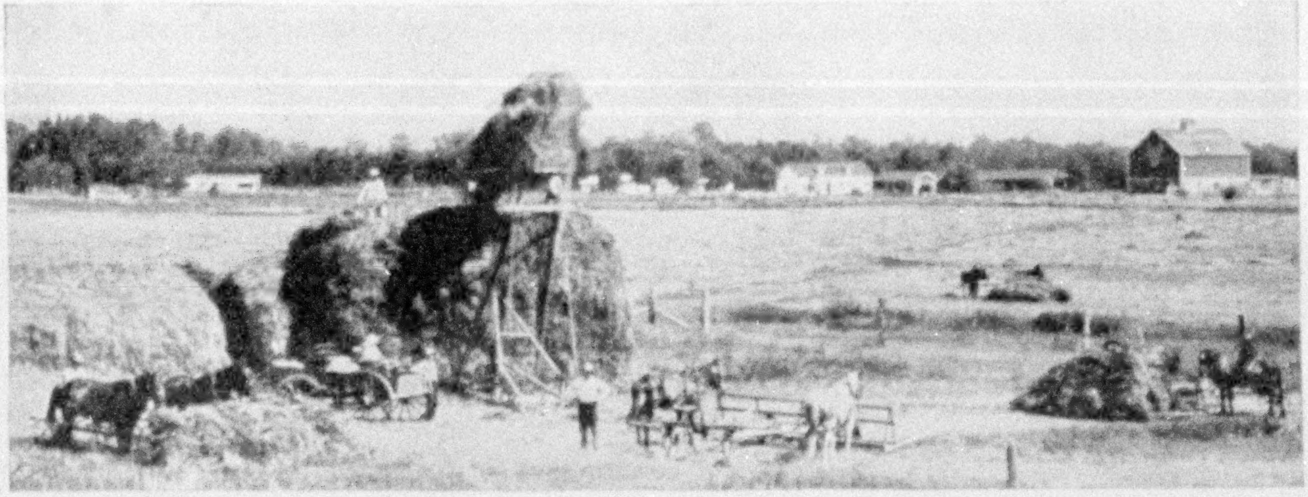

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WALTHAM WATCH COMPANY, Waltham, Mass.

Vol. XXIV, No. 1 WASHINGTON January, 1913

THE NATIONAL GEOGRAPHIC MAGAZINE

BEACONS OF THE SEA

Lighting the Coasts of the United States

By George R. Putnam, Commissioner of Lighthouses

THE sea-coast line under the jurisdiction of the United States is 48,881 statute miles, measured in three-mile steps. The general government provides lighthouses and other aids to navigation along all this coast, with the exception of the Philippine Islands, 11,511 miles, and Panama, where the marking of the coasts is maintained by the local governments. In addition, the United States provides lights along the American shores of the Great Lakes, 4,020 miles, and on interior and coastal rivers, 5,478 miles.

The United States Lighthouse Service thus maintains lights and other aids to navigation along 46,828 miles of coastline and river channels, a length equal to nearly twice the circumference of the earth. In this distance *it has 12,824 aids to navigation of all classes, sufficient to place one every two miles around the equator.*

In respect to territory covered and aids maintained, it is much the most extensive service of its kind under a single management. There are 1,462 lights above the order of river-post lights, and there are 762 lights having resident keepers, 51 light-vessel stations, and 438 lighted buoys. The total lighted aids of all kinds is 4,516. There are in all 933 fog signals, of which 510 are fog-signal stations, 43 submarine bells, 124 whistling buoys, and 256 bell buoys. There are 6,281 unlighted buoys, and 1,474 daymarks, or unlighted beacons. There are also 516 private aids to navigation, maintained at private expense, but under government supervision.

This service is carried on through an organization of 19 districts, under a central office in Washington. Each district is in charge of a lighthouse inspector and has a local office and one or more supply depots and lighthouse tenders. In all, there are 46 of these small vessels which carry the supplies to the stations and place and maintain the buoys and light vessels.

About 5,500 men are required for the lighthouse work, of whom 211 are in the executive, engineering, and clerical force; 1,733 are keepers of lights and depots, 1,570 care for post lights, 1,516 are on vessels, and 489 are in the construction and repair force.

The entire personnel is under the civil-service rules, and appointments and promotions are on a strictly merit system. This is of great importance for the maintenance of good organization and rigid discipline in a purely technical service, on the efficient conduct of which is directly dependent the safety of all the lives and all the property carried on the seas and the navigable waters of this country.

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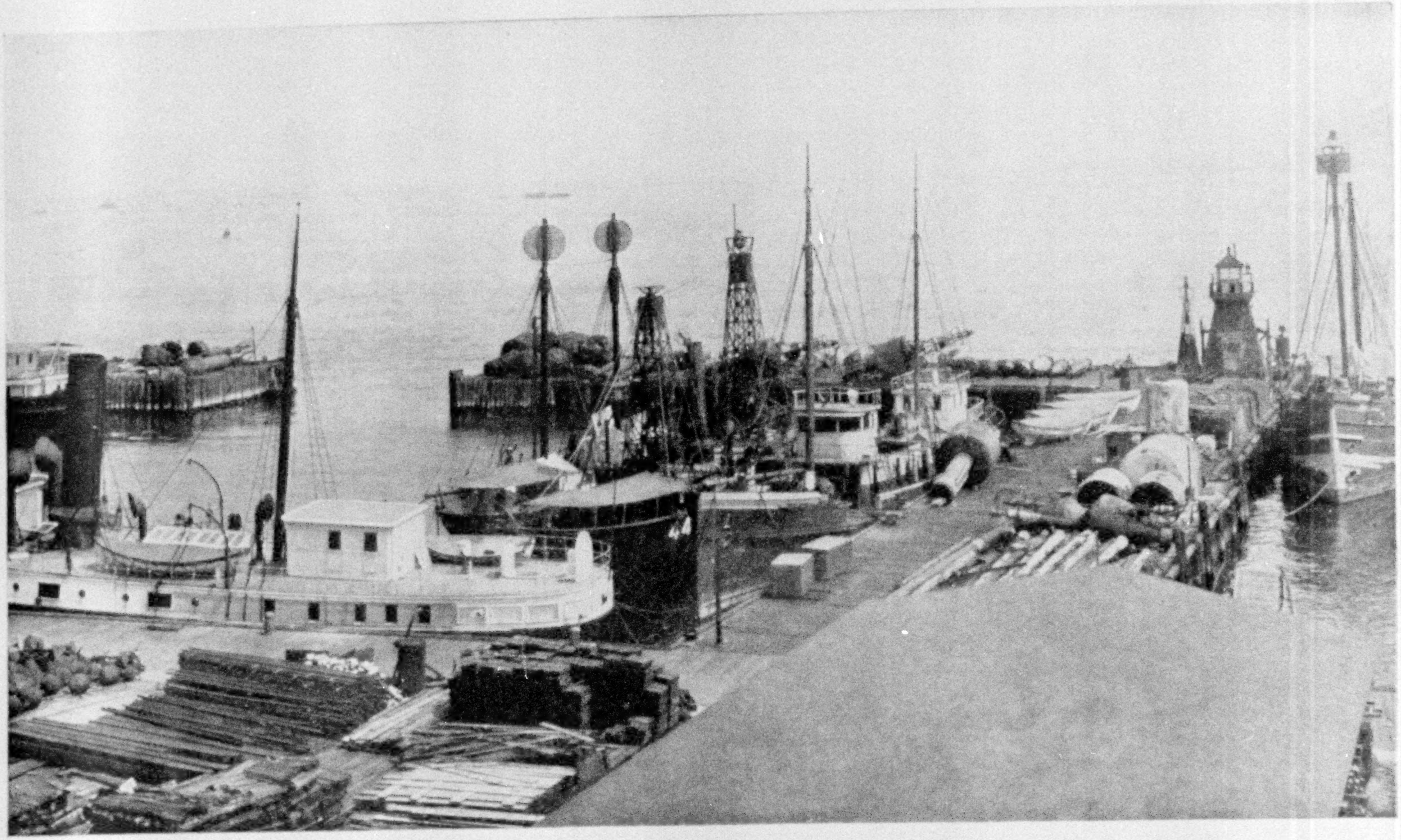
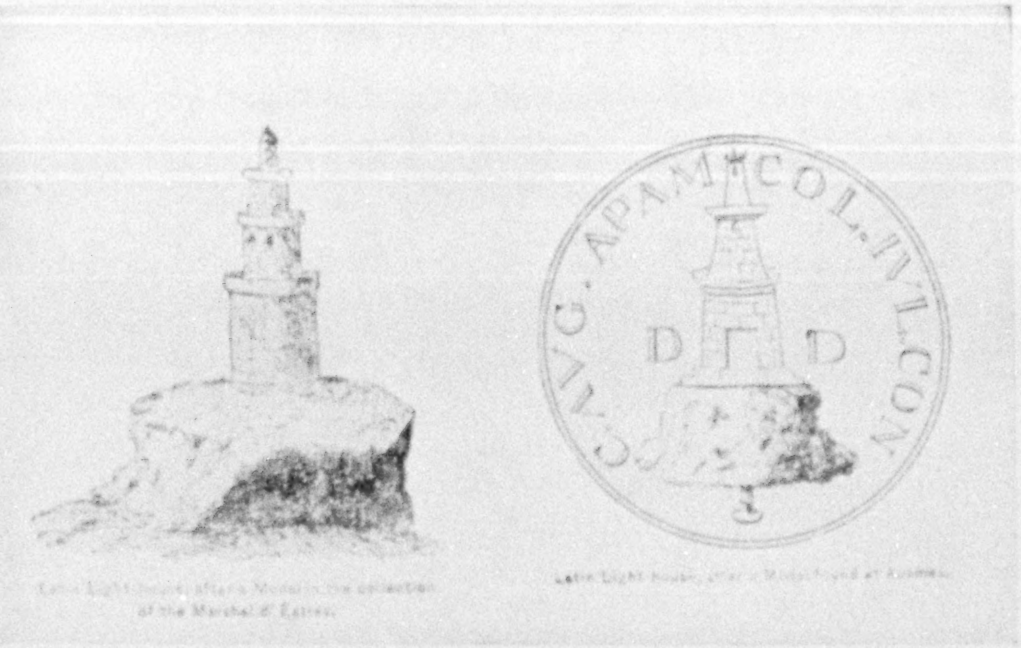


THE GENERAL LIGHTHOUSE DEPOT ON STATEN ISLAND, NEW YORK HARBOR

Lighthouse vessels are here repaired, buoys and supplies purchased, and special apparatus made and tested. Note the variety of gas buoys and other buoys on the dock, and light-ships and tenders in the basin


C. AVG. APAM. COL. IVL. CON
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Latin Light-house, after a Medal in the collection of the Marshal d'Estrées.

Latin Light-house, after a Medal found at Apamea.

LIGHTHOUSES OF ANCIENT TIMES, AS PICTURED ON ROMAN MEDALS

A lighthouse is mentioned as early as 660 B. C.; the Pharos, at Alexandria, built about 260 B. C., was one of the "seven wonders" of the world, and is estimated to have been about 400 feet high.

The annual maintenance cost of the entire service is close to $5,000,000, and in addition in recent years there has been expended about $1,000,000 a year on new lighthouse works and vessels. This service is supported by appropriations out of the general revenues, and no special light taxes are collected from shipping, as is customary in other countries.

At all important light stations there are from two to five keepers, who maintain a continuous watch of the light at night and of the approach of fog at all times. At less important stations there is but one keeper, or sometimes a single keeper cares for several neighboring lights. The average pay of keepers is less than $600 per year, but they receive also a ration allowance and usually quarters and fuel. The maximum salary at difficult offshore stations is $1,008. For the care of a post light along the rivers about $10 a month is paid, but this requires only a small amount of work each day.

At the general lighthouse depot on Staten Island, New York harbor, shops are maintained for the repair and manufacture of special lighthouse apparatus. This is also a general supply station for the service, supplies and equipment being purchased and tested and experimental and designing work being carried on. Many of the lighthouse vessels are overhauled or outfitted here. There are employed in this depot and offices 253 persons (see page 2).

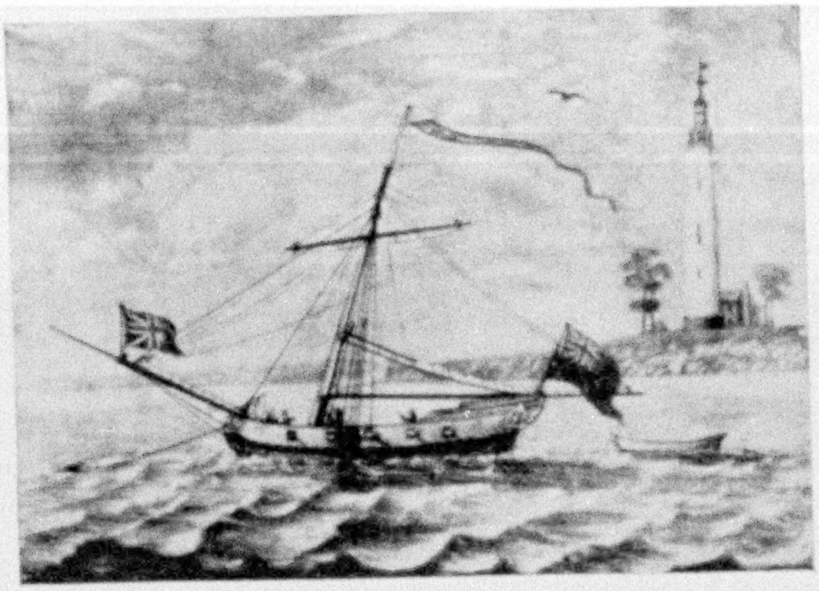
Light stations and vessels are inspected four times a year, and the districts and offices are themselves inspected from time to time by a general inspector and a traveling auditor.

An accurate cost keeping system has recently been introduced for the entire lighthouse service, so that at the end of the year the principal items of cost for each feature can readily be ascertained and compared. The following are average annual costs of operating various features of the service: Large lighthouse tender, $40,500; light vessel on exposed station, $15,300; important light station, with fog signal, $4,200; same without fog signal, $3,000; river-post light, $90; gas buoy, $100 to $300, according to size and type.

FAITHFUL LIGHT-KEEPERS

Although the pay is small and the life often lonely, the work attracts as a rule an excellent class of faithful men, willing to take large risks in doing their duty and also in helping those in distress. There are many cases of faithful service and bravery, of which the following are a few instances:

The hurricane of September, 1906, did serious damage to lighthouse property along the Gulf coast and a number of lives were lost at Sand Island and at



OLD BOSTON LIGHT (FROM A RARE PRINT OF 1729)

The first lighthouse built in North America, several times attacked, and finally destroyed in the Revolutionary War. The "great gun" on the right was the first fog signal in America (see page 7).

Horn Island light stations; at the latter the keeper, his wife, and daughter being drowned. Twenty-three lights were destroyed by this storm. On October 3 the inspector of the eighth district made this report: "The employees of the Lighthouse Service have, as was to be expected, maintained its credit. I have heard stories of gallant actions, and I have witnessed the uncomplaining manner in which they and their families have taken their great losses and deprivations, also their cheerfulness in beginning all over again."

The keeper of post lights on the St. Johns River, Florida, after being severely injured, went on with his work, as he tells in this report, in May, 1912: "I arrived at the light at 9.30 a. m. I took the lamp out, and as I went to blow it out it exploded and knocked me off the light (22 feet), and I did not know anything until 12 m. When I came to I found the lamp gone. I crawled back to the boat (250 feet), got another lamp and put it on the beacon and lit it. Then came home (8 miles). Injury: broken leg just above the ankle and severe bruised shin and bruised arm and lick on head."

There is a pathetic story of the keeper of Key West light, who after 35 years of service became so absorbed in his duty that he would not leave his task, even for a short vacation, laboring under the delusion that no one but himself could properly care for the light. On a certain very stormy night a ship was wrecked near the fort at Key West. The keeper, then nearly 70 years of age, excited by the storm and the prolonged whistle blasts of the unfortunate vessel, insisted that the wreck was due to the front-range light being out, although it had just been examined by his son and found burning properly. In spite of his feeble condition he procured a lantern and, resisting efforts to detain him, went on foot in the storm to the range light and satisfied himself that it was really burning. He died not long afterward.

The keeper of Van Weis Point light, New York, died recently at the age of 93 years, having tended this light for 52 years.

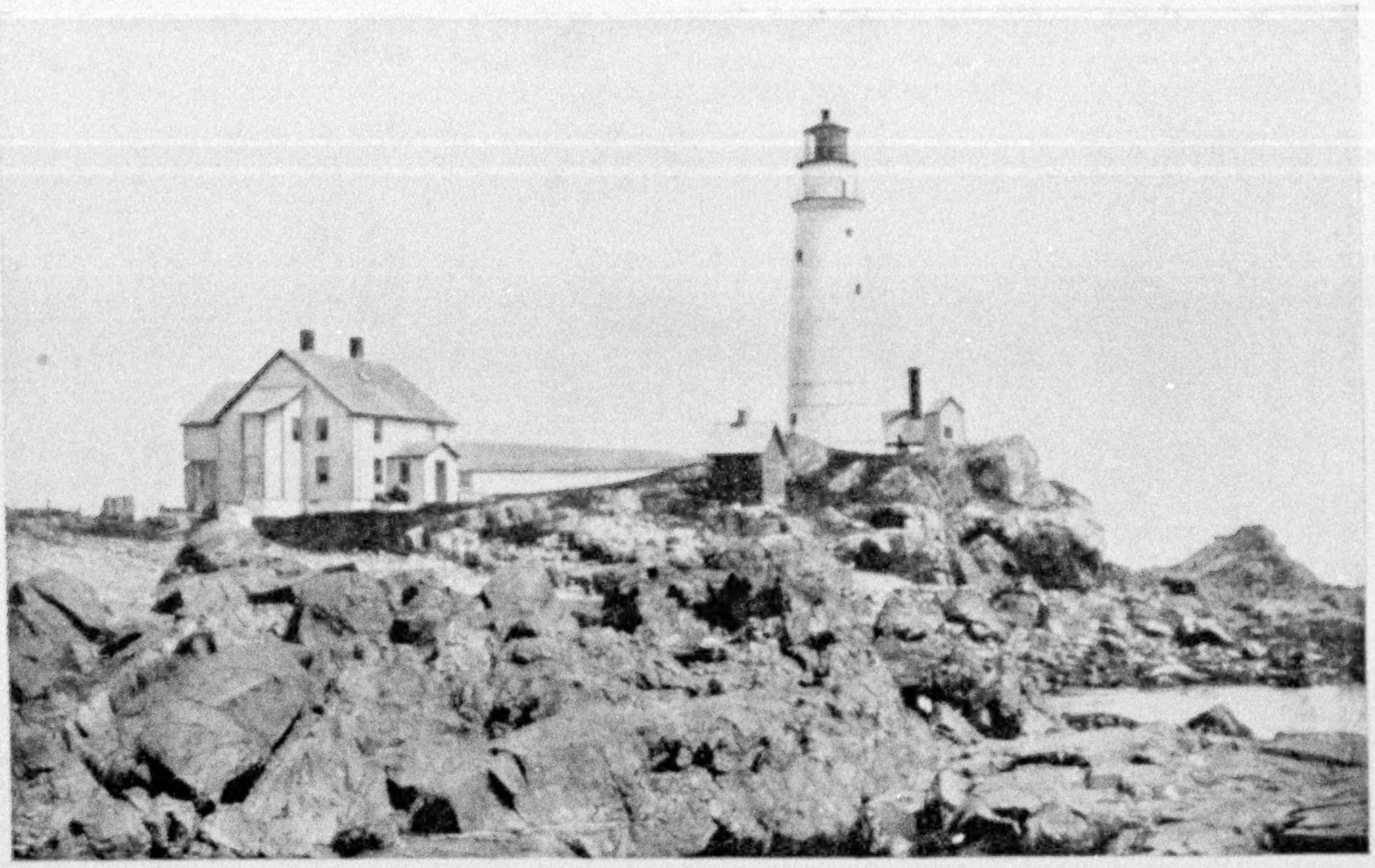
At present there is no provision in this country for the retirement of light-keepers on account of age, long service, or disability resulting from their work.

The keeper of the most distant light in Alaska—Cape Sarichef—returned recently, his first absence in three years. At this station there is sometimes an interval of five months between mails, and the keepers' only neighbor is a trapper, 10 miles away. A light-keeper on the Columbia River, Oregon, has taken only two days leave in 23 years, and one of these two days was for the purpose of being married.

WOMEN LIGHT-KEEPERS

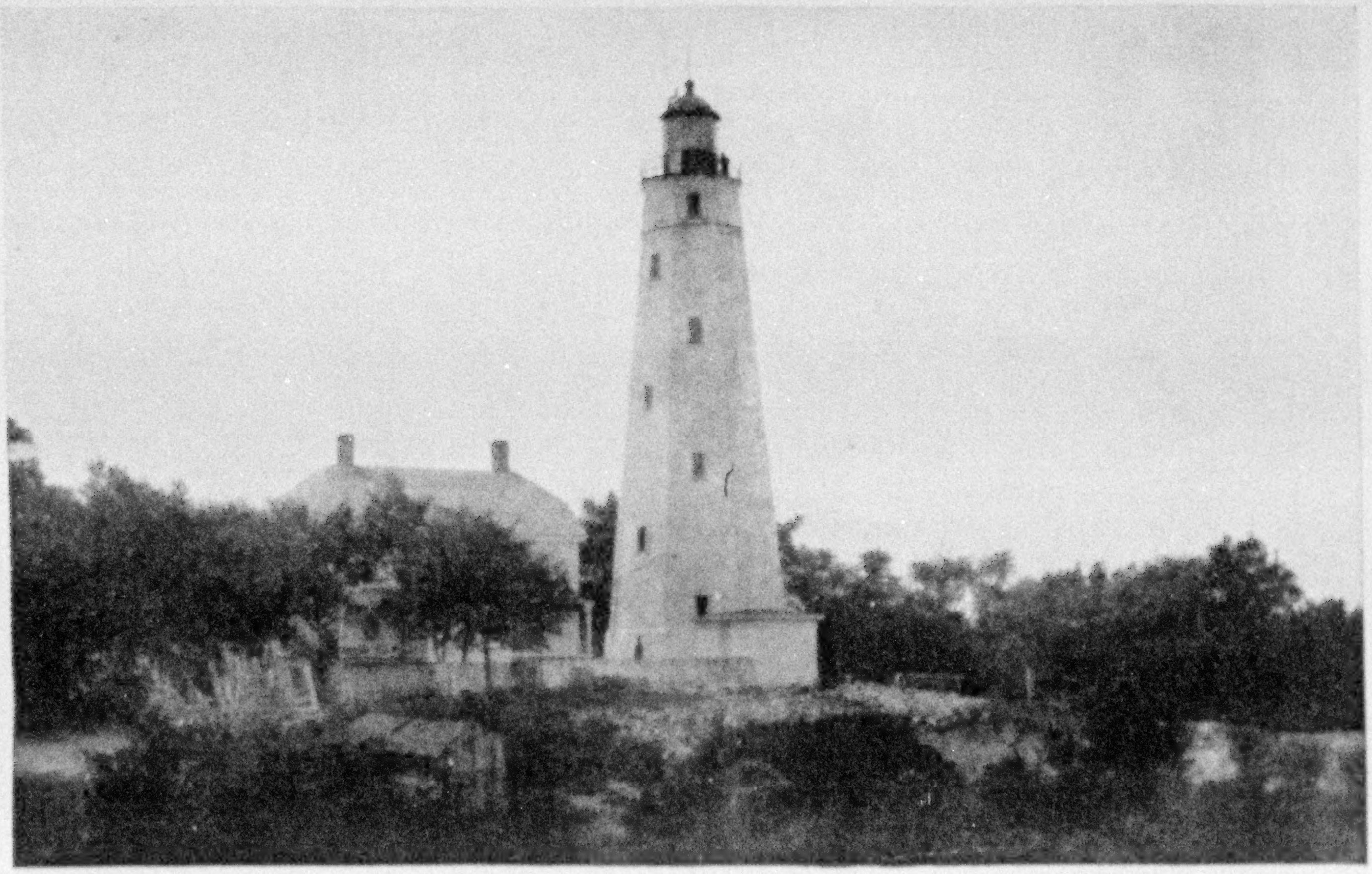
There are a number of women light-keepers. One of these, the keeper of Angel Island light in San Francisco Bay, reported that after the machinery of the fog signal was disabled on July 2, 1906, she "had struck the bell by hand for 20 hours and 35 minutes, until the fog lifted," and that on July 4, when the machinery was further disabled, she "stood all night on the platform outside and struck the bell with a nail hammer with all my might. The fog was dense."

A widely known woman light-keeper was Ida Lewis, who died about a year



THE PRESENT BOSTON LIGHT

Built in 1783 by Massachusetts and ceded to the United States in 1790 (see page 7)



SANDY HOOK LIGHTHOUSE, NEW YORK

This and Cape Henlopen lighthouse, both built in 1764, are the oldest existing lighthouse towers in this country. The walls at the base are 7 feet thick

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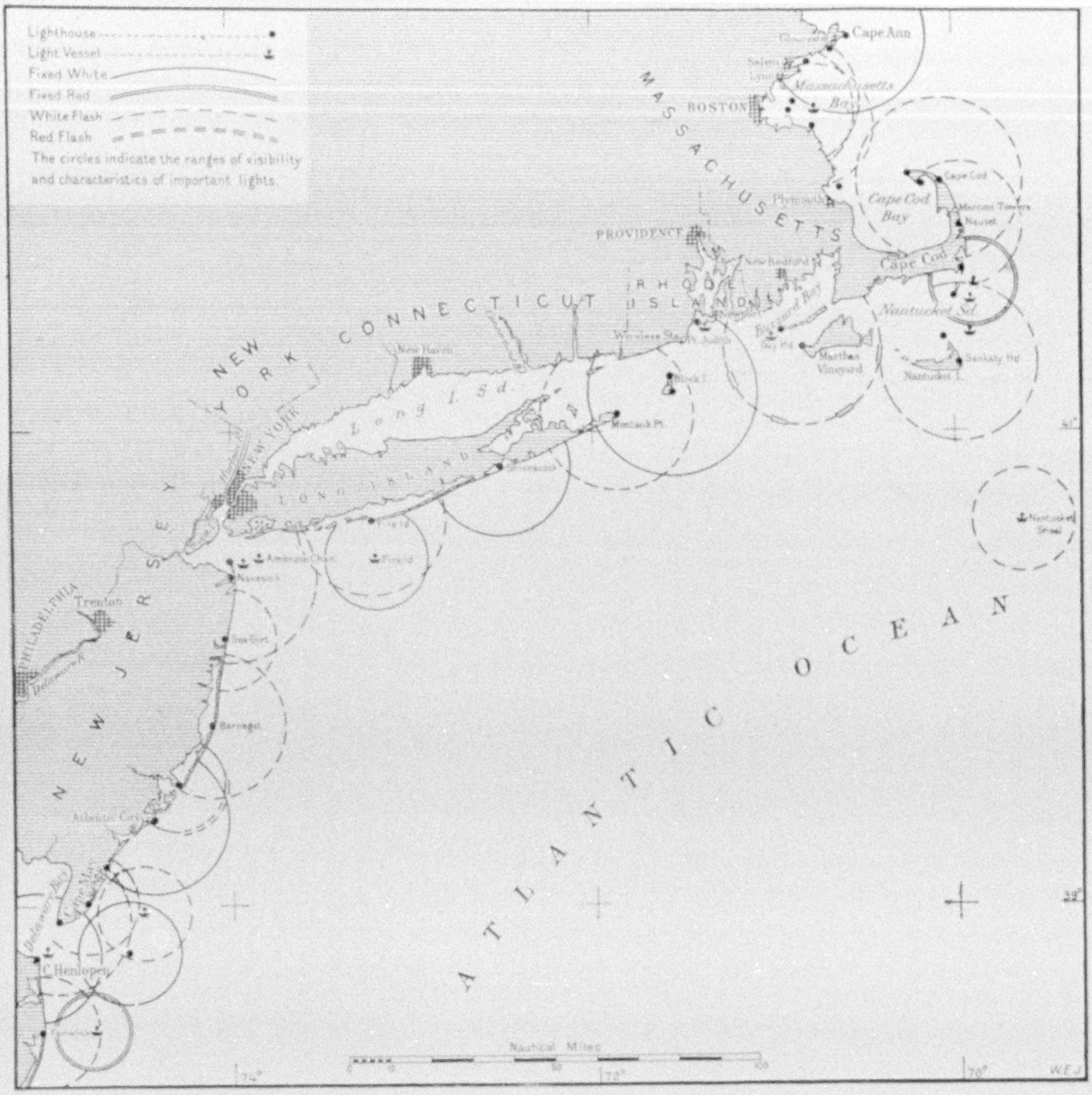

Lighthouse
Light Vessel
Fixed White
Fixed Red
White Flash
Red Flash
The circles indicate the ranges of visibility and characteristics of important lights.
Cape Ann
Gloucester
Salem
Lynn
Massachusetts Bay
BOSTON
MASSACHUSETTS
Plymouth
Cape Cod
Cape Cod Bay
Marconi Towers
Nauset
PROVIDENCE
New Bedford
RHODE ISLAND
CONNECTICUT
Buzzards Bay
Nantucket Sd.
Martha's Vineyard
Nantucket I.
Sankaty Hd.
Wireless Sta.
Pt. Judith
Block I.
Montauk Pt.
New Haven
Long I. Sd.
NEW YORK
LONG ISLAND
Shinnecock
Fire I.
Ambrose Chan.
Navesink
Sea Girt
Barnegat
Atlantic City
Cape May
Delaware Bay
C. Henlopen
Trenton
PHILADELPHIA
Delaware R.
NEW JERSEY
Nantucket Shoal
ATLANTIC OCEAN
Nautical Miles
0
10
50
100
74°
72°
70°
41°
39°
W.E.J.

CHART SHOWING THE LIGHTS THAT MARK THE APPROACHES TO THE GREAT HARBORS OF BOSTON, NEW YORK, AND PHILADELPHIA (SEE PAGE 15)

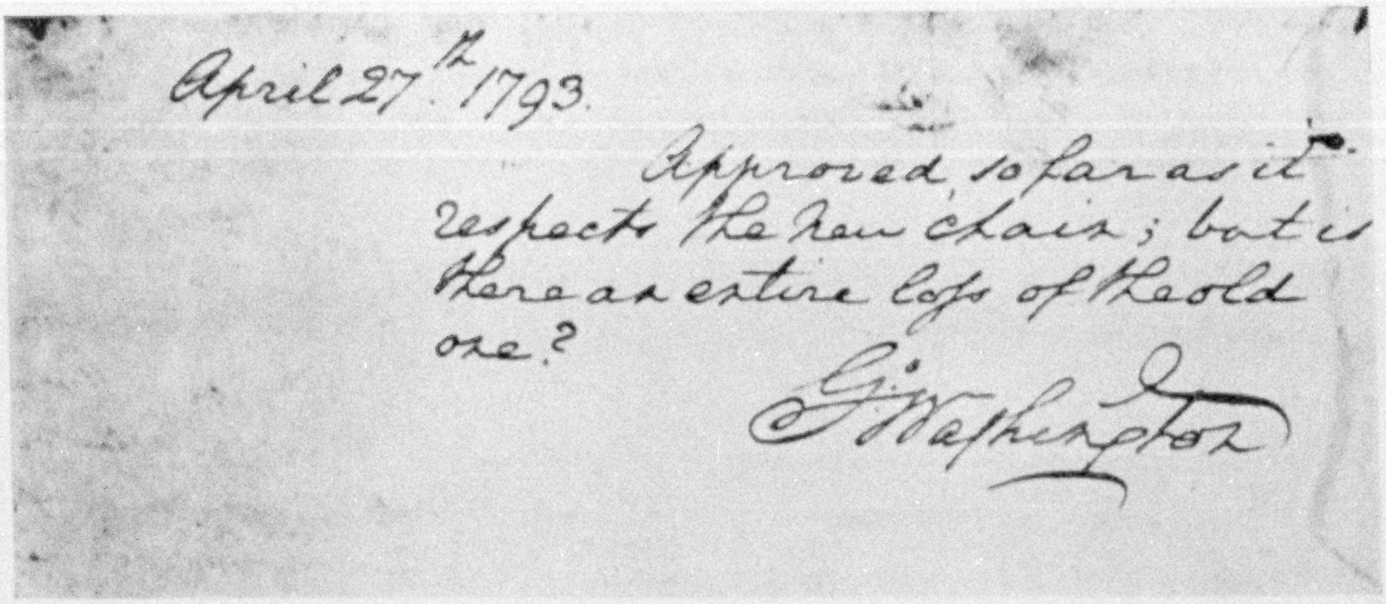
Note the overlapping of the arcs of visibility of lights on an important coast. The lights differ in character and thus may easily be distinguished

ago. She lived at Lime Rock lighthouse, on a ledge in Newport harbor, for 57 years, her father having been appointed keeper when she was 12 years old. She was keeper of the light for 32 years. There are reports of her having rescued 13 persons from drowning. On one occasion, it is said, she saved three men who had swamped while attempting to pick up a sheep, and then she rescued the sheep also.

Because of the difficult life, keepers at isolated stations are granted shore liberty and leave 72 days a year, and crews of light vessels 90 days a year.

THE BOSTON LIGHT WAS THE FIRST AMERICAN LIGHTHOUSE

The first lighthouse on this continent was built by the province of Massachusetts, in 1715-1716, on an island in the entrance to Boston harbor. In 1713 a



April 27th 1793.

Approved so far as it respects the new chain; but is there an entire loss of the old one?

Go: Washington

AN ENDORSEMENT BY PRESIDENT WASHINGTON, IN HIS OWN HANDWRITING, ON A LIGHTHOUSE DOCUMENT

Showing the caution exercised by the first President in approving a contract for making a chain for a buoy (see page 10)

committee reported to the General Court on "the most convenient Place for Erecting a Light House, which will be of great Use not only for the Preservation of the Lives and Estates of Persons designing for the Harbour of Boston and Charlestown but of any other Place within the Massachusetts Bay," and the court resolved "that the Projection will be of general publick Benefit and Service and is worthy to be encouraged," and that the want of such a lighthouse "hath been a great Discouragement to Navigation by the loss of the lives and Estates of several of His Majesties Subjects."

In 1719 the keeper petitioned the General Court "that a great Gun be placed on Said Island to answer Ships in a Fog." The court voted the gun, and it was probably the earliest fog signal established in this country (see page 4).

The light was supported by light dues of one penny per ton, levied by the receiver of impost at Boston on all incoming and outgoing vessels except coasters. This lighthouse was an object of attack during the early part of the Revolutionary War, and was burned by the Americans and finally blown up by the British in 1776. A new lighthouse on the same site was built in 1783 by Massachusetts, and this, with various alterations, is the present Boston light.

Although candles and even coal fires appear to have been used in lighthouse illumination in England to a much later date, Boston light was probably illuminated from the first by oil lamps. In 1789 the light was produced by 16 lamps in groups of 4. Crude lenses and reflectors were fitted in 1811, and also revolving mechanism, it having previously been a fixed light. In 1838 Boston light is described as "a revolving light, consisting of 14 Argand lamps, with parabolic reflectors," the lamps being "of about the volume of similar lamps in family use." In 1839 large reflectors 21 inches in diameter were fitted to this light. Boston light was provided with a Fresnel lens in 1859.

Apparently the gun was the only fog signal at this station until about 1852, when a fog-bell was installed. A mechanical striking bell was installed in 1869, in 1872 a fog trumpet, and in 1887 an air siren.

THE ESTABLISHMENT OF OUR LIGHTHOUSE SERVICE WAS ONE OF THE FIRST ACTS OF THE FEDERAL GOVERNMENT

Several other lighthouses were built and maintained by the colonial governments. On the organization of the national government, at the first session of Congress, an act was passed, approved on August 7, 1789, providing that all expenses "in the necessary support, maintenance and repairs of all lighthouses,

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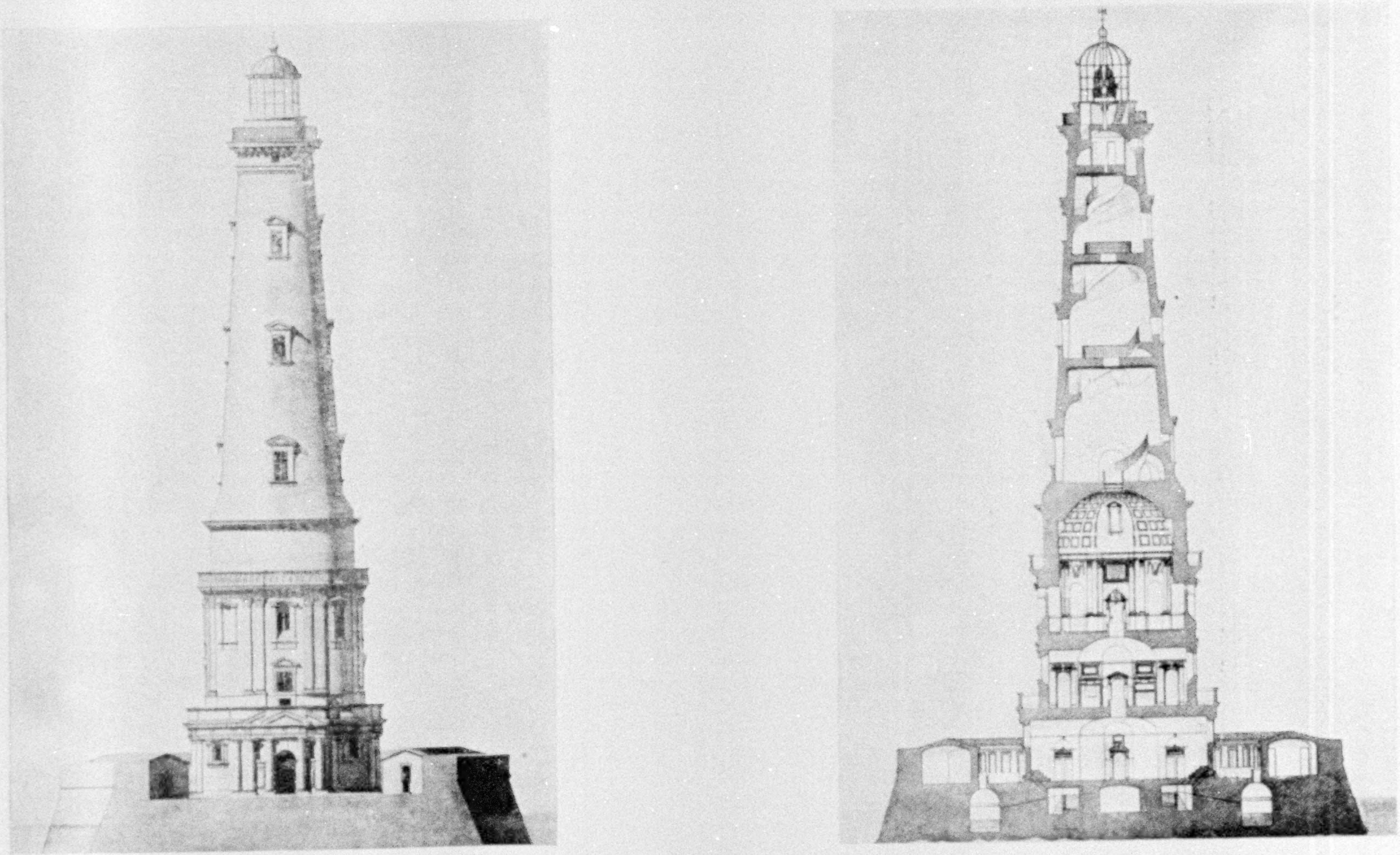
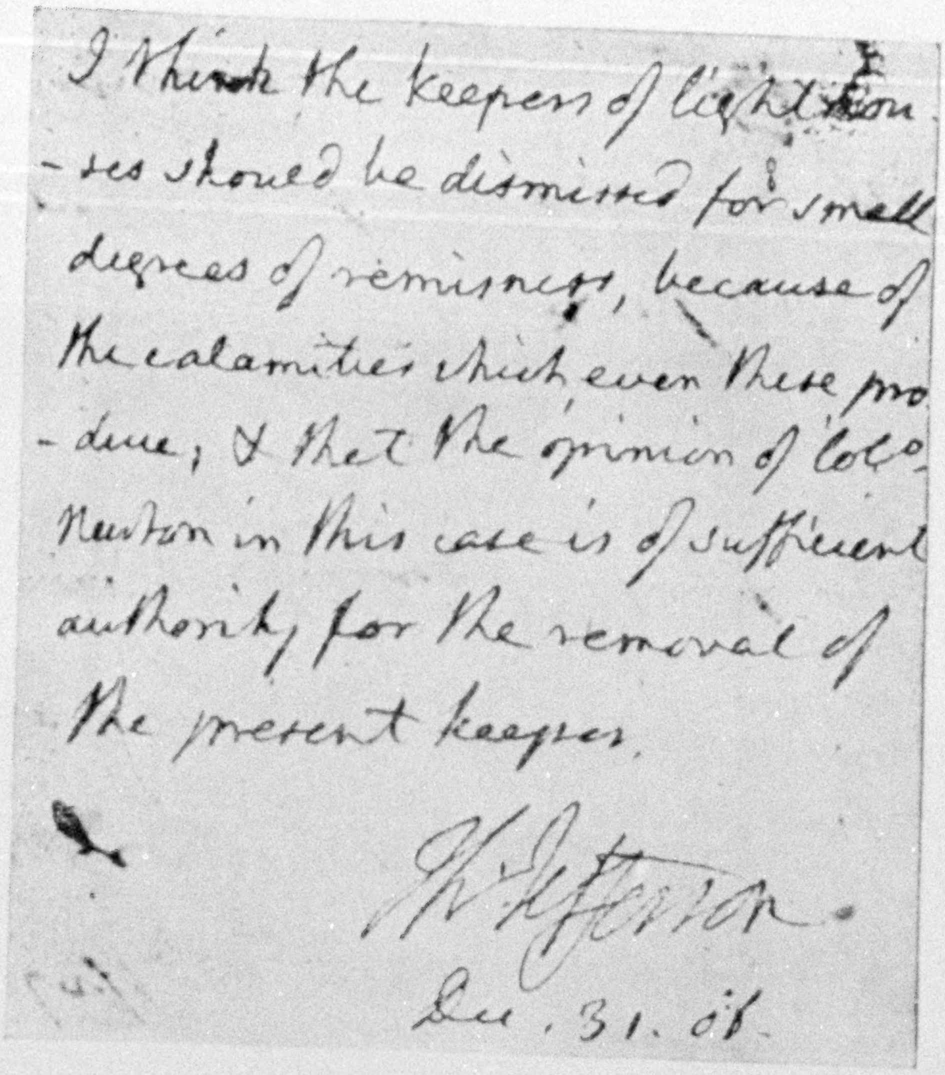


VIEW AND SECTION OF THE BEAUTIFUL LIGHTHOUSE ON THE COAST OF FRANCE, PHARE DE CORDOUAN, COMPLETED IN 1611 AND SINCE ALTERED; THE OLDEST SEA-SWEPT LIGHTHOUSE NOW IN EXISTENCE (SEE PAGE 17)



I think the keepers of light hou-ses should be dismissed for small degrees of remissness, because of the calamities which, even these pro-duce; & that the opinion of Colo. Newton in this case is of sufficient authority for the removal of the present keeper.

Th: Jefferson

Dec. 31. 06.

AN ENDORSEMENT BY PRESIDENT JEFFERSON, IN HIS OWN HANDWRITING

Expressing his opinion of the responsibility of light-keepers (see page 15)

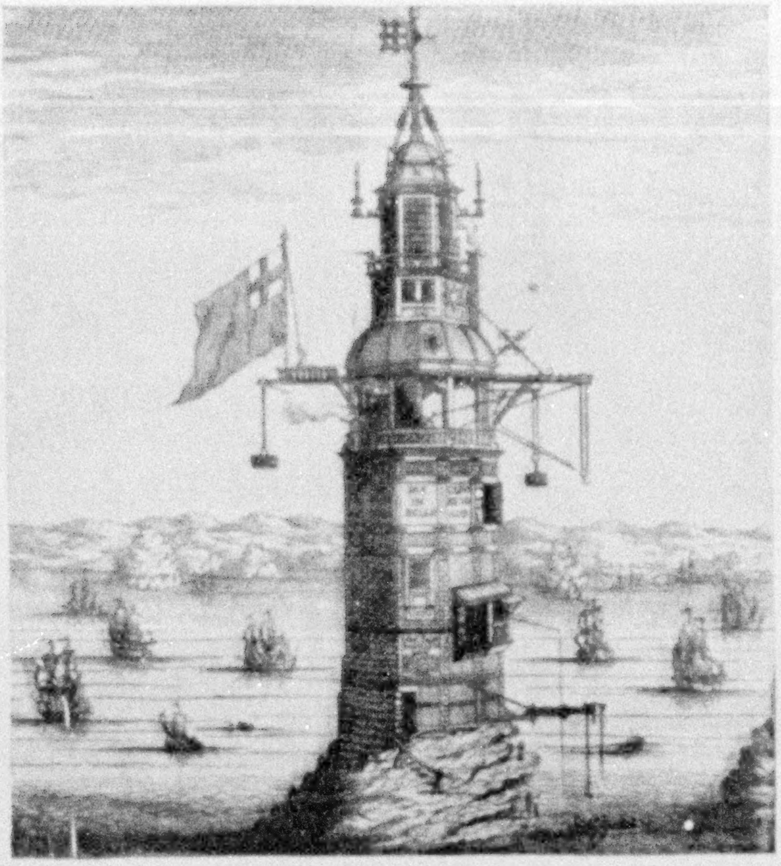
beacons, buoys and public piers erected, placed, or sunk before the passing of this act, at the entrance of, or within any bay, inlet, harbor, or port of the United States, for rendering the navigation thereof easy and safe, shall be defrayed out of the Treasury of the United States." Thus the Lighthouse Service was one of the earliest established by the Federal government, though it has been conducted under several different forms of administration.

The maintenance of lighthouses, buoys, and other navigational aids was, at the organization of the government, placed under the Treasury Department, and the details of lighthouse work were directed personally by the Secretary of the Treasury — Alexander Hamilton — by whom many of the earlier papers are signed. This work was during two later periods placed under the Commissioner of Revenue.

In 1820 the administration of the lighthouses devolved upon the Fifth Auditor of the Treasury, who was popularly known as the general superintendent of lights. Mr. Stephen Pleasonton discharged these duties for 32 years. In 1852 Congress established the United States Lighthouse Board, composed of three naval officers, three army engineers, and two civilians, with the Secretary of the Treasury as *ex-officio* President of the Board. The Chairmen of this Board were Admirals in the Navy, with the single exception of Prof. Joseph Henry, who was Chairman from 1871 to 1878. In 1910 the present Bureau of Lighthouses was established by Congress, under charge of a Commissioner of Lighthouses and other executive officers appointed by the President. The Lighthouse Service is now a part of the Department of Commerce and Labor, to which it was transferred from the Treasury in 1903.

Under the act of 1789, 13 lighthouses were ceded to the United States by the several States, though apparently but eight of these were in actual operation at the date of the act (these are the eight first named in the list). The following are the lighthouses ceded, most of which are standing at the present time, although much altered:

Portsmouth Harbor, N. H.
Boston, Mass.
Plymouth (Gurnet), Mass.
Brant Point, Nantucket Island, Mass.
Beavertail, Newport, R. I.
Sandy Hook, N. Y.
Cape Henlopen, Del.
Charleston, S. C.
Portland Head, Maine.
Newburyport Harbor, Plum Id., Mass.
Cape Ann, Thatcher Island, Mass.
New London Harbor, Conn.
Tybee, Ga.



THE FIRST EDDYSTONE LIGHT, OFF THE SOUTH COAST OF ENGLAND

The Eddystone is the most famous lighthouse in the world. Four towers have been built on this dangerous rock. This, the first one, of fantastic design, was completed in 1699 and destroyed in the great storm of November, 1703, and the keepers and the engineer who built it were lost (see page 17).

The oldest of the existing lighthouse structures in this country is the tower at Sandy Hook, New York, built in 1764. The lighthouse at Cape Henlopen, Delaware, was completed the same year. These are similar in design—massive structures of stone and brick, with walls 7 feet thick at the base (see page 5).

PERSONAL ATTENTION GIVEN BY PRESIDENT WASHINGTON TO LIGHTHOUSE MATTERS

Massachusetts, in ceding her lighthouses, showed her caution with respect to the new government by providing "that if the United States shall at any time hereafter neglect to keep lighted, and in repair, any one or more of the lighthouses aforesaid, that then the grant of such lighthouse or lighthouses so neglected shall be void and of no effect;" and also "that if the United States shall at any time hereafter make any compensation to any one of the United States for the cession of any lighthouse . . . like compensation be made to this Commonwealth by the United States, for the cession of the Light Houses aforesaid, in proportion to their respective values."

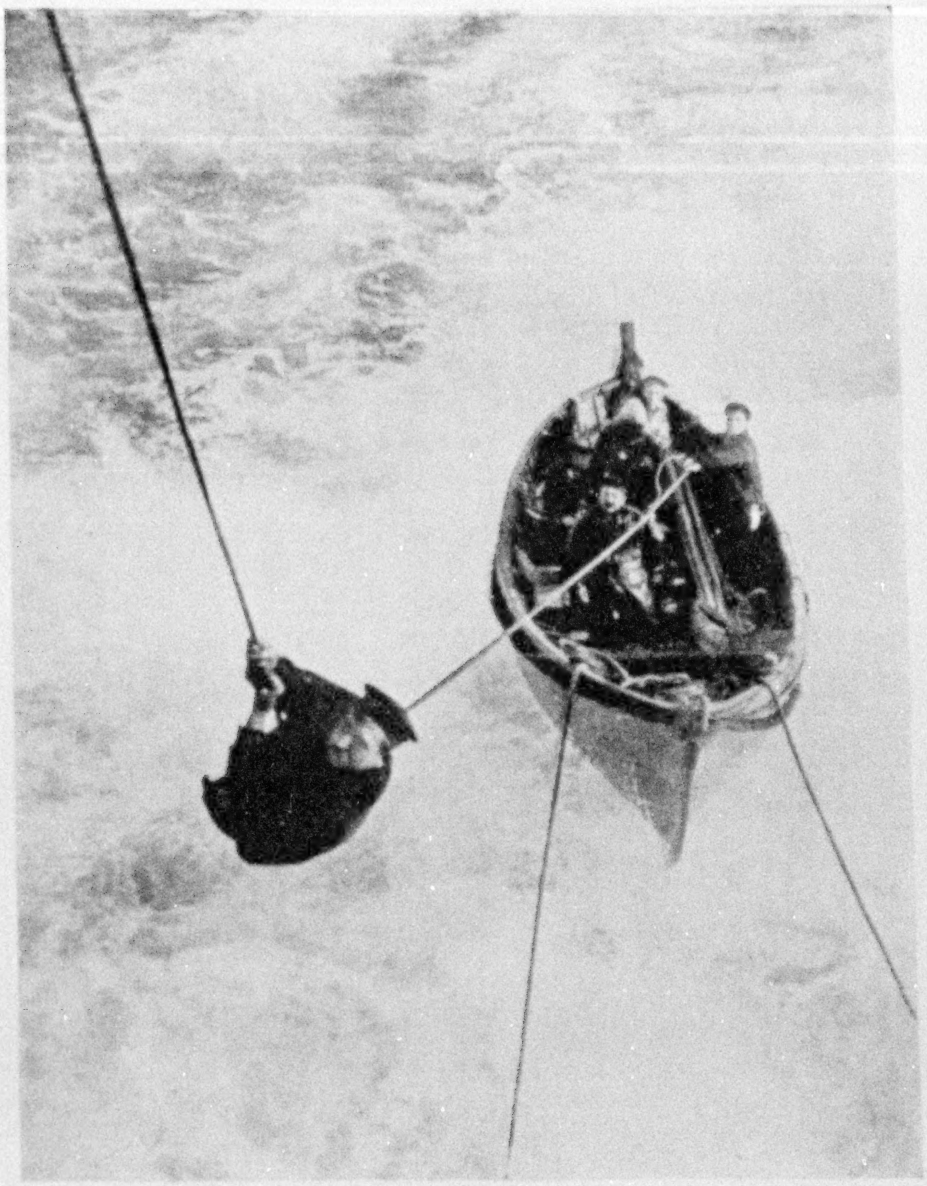
There are many interesting documents in the early archives of the service showing the attention given by high officers of the government to matters of lighthouse detail. President Washington personally approved such contracts as these: for the purchase of spermaceti oil for Cape Henry lighthouse, "to erect, sink, and build a well for water" for Cape Henlopen lighthouse, and for making "a mooring chain for one of the Floating Beacons of the Delaware Bay." On the last document appears the endorsement, all in Washington's handwriting, "April 27th, 1793. Approved, so far as it respects the new chain; but is there an entire loss of the old one? G^{o}. Washington." There is a proposal for Tybee lighthouse "for a hanging stair case for the sume of £160," or "should a plain square stair case be preferred," for £110, with the endorsement, "Approved with the plain stair case. G^{o}. Washington."

During the earlier administrations the salaries of lighthouse-keepers were fixed by the President, and appointments of keepers were approved by him. The following document is of interest as showing the salaries then paid:

"UNITED STATES, *July 18th, 1793*

"By the President's command T. Lear has the honor to inform the Secretary of the Treasury, that the President having duly considered the Representation of the Commissioner of the Revenue and the other documents relative to the compensations of the Keepers of the Light Houses, which were put into his hands by the Secretary, approves of the alterations of certain compensations as suggested by the Secretary, viz:

"1st. For the Keeper of the Light Houses on Thatcher's Island per annum, *266 2/3* doll.



LANDING THE RELIEF AT THE EDDYSTONE

The keepers in turn are allowed shore liberty. It is often difficult to land at a wave-swept lighthouse

"2. do. Boston Bay, 266 2/3 doll.
"3. do. Plymouth, 200 doll.
"4. do. Portland Head, 160 doll.
"5. do. Conanicut, 160 doll.
"6. do. New London, 120 doll.
"7. do. Sandy Hook, 266 2/3 doll.

"To commence from the 1st day of the present Month.—

"The President thinks it proper that the Keeper of the Light House at Portsmouth be informed, that he must reside on the spot where the Light House is, if he continues in that office, and that he will not be permitted to employ a deputy to take care of the Light House, unless upon some special occasion.

"Tobias Lear,
"Secretary to the President of the United States."

The Commissioner of the Revenue in 1797 writes to the Secretary of the Treasury regarding salaries of keepers: "In the case of Major ——, there are the advantages of plenty of fuel, without expense, upon the public land, the opportunity to fish for his family use, or even for sale, a boat to fish in will be furnished for passing to the main, there is a little land for tillage and grass, and for a plentiful garden. The place is represented to be very healthy. . . . I have been thus particular because the salaries of keepers appear to have been subjected to some miscalculation on their parts from the unnecessary degree of former standing, which some of the candidates have had. It is plain at first view, that the above duties are not in their nature adapted to the standing of a field officer, or of a Major of Brigade."

A recommendation of a person for appointment as keeper in 1809 stated that the applicant "being by occupation a mason will engage to keep the Light House white washed, should he receive the appointment, free from any expense to the Government as long as he is its Keeper."

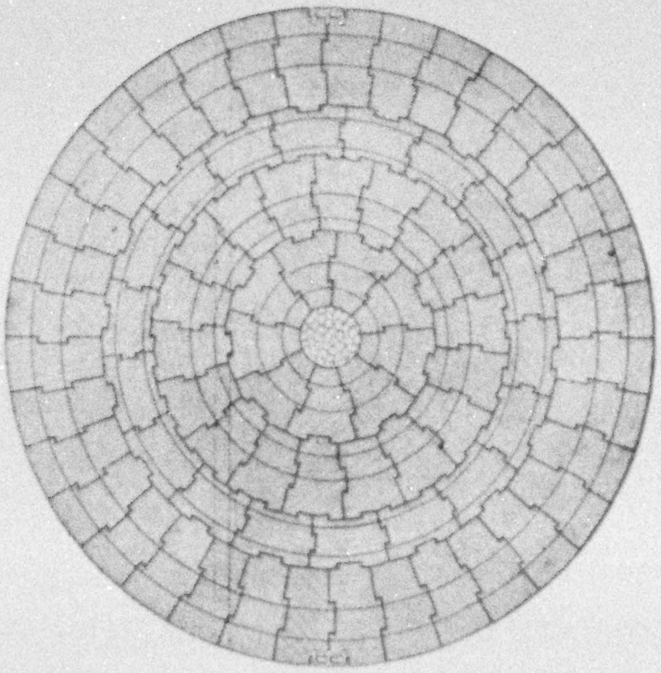
THE PETITIONS OF EBENEZER SKIFF, KEEPER OF GAY HEAD LIGHTHOUSE

The keeper of Gayhead lighthouse in 1805 made this petition for an increase of salary:

"Gayhead, October 25, 1805.

"Sir: Clay and Oker of different colours from which this place derived its name ascend in a Sheet of wind pened by the high Clifts and catch on the light House Glass, which often requires cleaning on the outside—tedious service in cold weather, and additional to what is necessary in any other part of the Massachusetts.

THE FOURTH AND PRESENT EDDYSTONE LIGHTHOUSE, COMPLETED IN 1881 (SEE PAGE 17)



A SECTION OF THE BASE OF THE EDDYSTONE TOWER

Showing how the stones are dovetailed so as to withstand the terrible buffeting of the sea

"The Spring of water in the edge of the Clift is not sufficient. I have carted almost the whole of the water used in my family during the last Summer and until this Month commenced, from nearly one mile distant.

"These Impediments were neither known nor under Consideration at the time of fixing my Salary.

"I humbly pray you to think of me, and (if it shall be consistent with your wisdom) increase my Salary.

"And in duty bound I am your's to Command

"EBENEZER SKIFF,
Keeper of Gayhead Light House.

"ALBERT GALLATIN ESQUIRE
"Secretary of the Treasury."

In consequence of this letter President Jefferson approved of increasing his salary by $50 to $250 per annum.

Ten years later the same Ebenezer Skiff petitions for an increase of salary on these grounds, some of which have a familiar ring, although the spelling has somewhat changed. The letter is quoted in full, as of interest in showing the life of a light-keeper at that date:

"*To Samuel Smith Esquire Commissioner of the Revenue*

"SIR: Clay ochre and earth of various colours from which this place derived its name ascend in a sheet of wind from the high clifts and catch on the glass of the light-house, which glass requires to be often cleaned on the outside:—Tedious service in cold weather and not so commonly necessary in any other place in the Massachusetts, nor in any of the New England States.

"The Spring of water in the edge of the clifts, by means of their late caving has become useless. I cart the water used in my family more than half a mile, necessarily keep a draught horse and carriage for that purpose and frequently have to travel in a hilly common extending five miles to find the horse. Truely I catch some rainwater and it is as true that many times I empty it coloured as red as blood with oker blown from the clifts.

"My firewood is brought from the Mainland and, there being neither harbor nor wharf here, is more expensive than in seaports. Keepers in some places get their wood with little cost; but here the native Indians watch the shores to take all drifts.

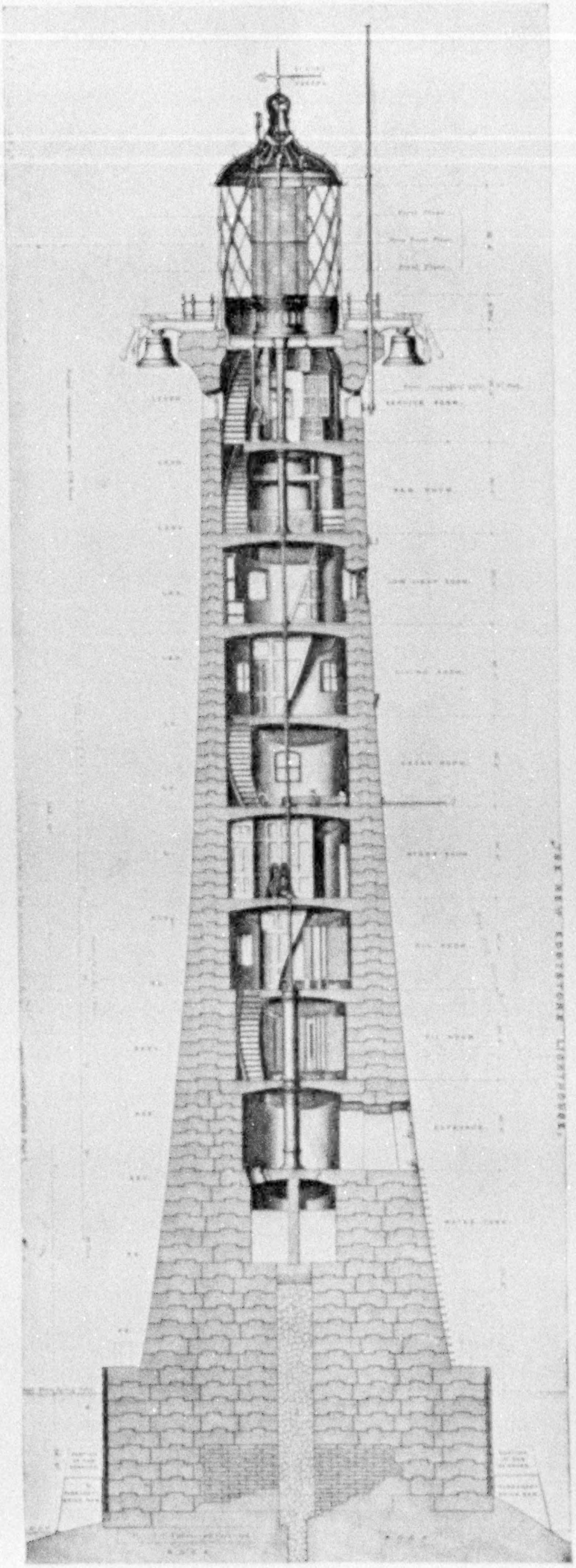
"The lately constructed light with a stone revolves by a clock which is to be stopped every time anything is done to the fire, which, in cold weather, must be kindled the sun an hour high, or sooner, and recruited until eleven o'clock, or after, when I have to trim the lamps and wind up the weights of the clock and can go into bed at nearly midnight until which a fire is kept in the dwelling-house consuming more wood than when I tended the former light.

"It is about eight miles from here to a gristmill and in the common way of passing are creeks not fordable at all seasons.

"The business respecting the light is, mostly, done by me in person, yet I occasionally leave home to procure wood and many other necessaries; previous to which I have to agree with and instruct some trusty white person to tend the light in my absence: If my salary would admit I would hire some person to live constantly with me lest I should be sick—I have no neighbors here but Indians or people of colour.

"Tending the former light might be deemed a simple business if compar'd with the tendance of the present complicated works and machinery, which requires much time care &c.

"Almost any man or lad under my wife's care could light the former lamp



A SKETCH OF THE INTERIOR OF THE EDDYSTONE LIGHTHOUSE
Showing the foundation, dovetailing of stones, and interior arrangement

PRESENT STONE LIGHTHOUSE ON MINOTS LEDGE, MASSACHUSETTS: NOTE THE BREAKING SURF

This structure ranks among the difficult lighthouse engineering works of the world. During the first summer only 130 working hours were obtained on the rock, and after three years' work only four stones of the foundation had been laid. Commenced in 1855 and completed in 1860 (see page 18).

and do the business a short time; but the case is not so now.

"When I hire an Indian to work I usually give him a dollar per day when the days are long and seventy five cents a day when the days are short and give him three meals: Now supposing the meals worth twenty-five cents each they amount to seventy five cents which is seven cents more than the wages for my service both a day and night (while I board myself) only sixty eight cents, computing my Salary (as it now is) at two hundred and fifty dollars a year and the year to consist of three hundred and sixty five days.

"I have the use of two acres of land intersected with buildings, the use of a small dwellinghouse and a small barn.

"I refer you to Capt. Winslow Lewis Superintendent of the Lamps &c. for the truth respecting all of the above particulars that he is acquainted with—and before I forward this Application shall lay before the Selectmen of Chilmark, which adjoins Gay Head, for their inspection; And in duty bound I humbly pray you to take this Matter into your wise consideration and afford me relief by granting an increase to my Salary.

"Gay Head 2nd November 1815.

"I am Sir with all possible respect yours to command,

"EBENEZER SKIFF."

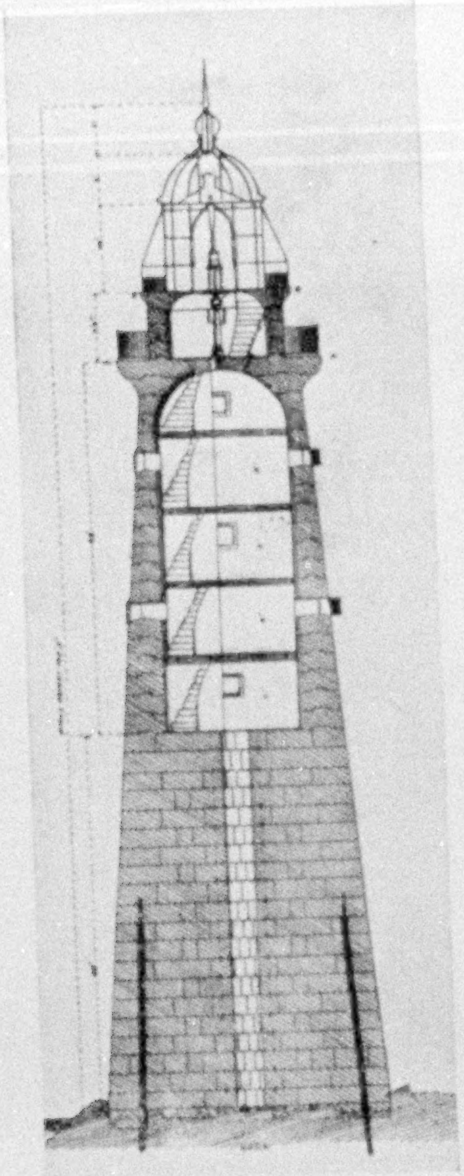
As a result of this letter, President Madison approved of a further increase of $50 in his salary.

CHARACTERISTIC ENDORSEMENTS BY JEFFERSON

On a recommendation to appoint Jared Hand as keeper of Montauk Point light

STANNARD ROCK LIGHT, MICHIGAN

Built in 11 feet of water, 24 miles from the nearest land, it marks the most dangerous reef in Lake Superior. It is the most distant from shore of any lighthouse of this country.



SECTION OF MINOTS LEDGE LIGHTHOUSE

Showing fastening of stones and interior arrangement. It is 107 feet from base to summit.

to succeed his father, President Jefferson wrote this endorsement:

"I have constantly refused to give in to this method of making offices hereditary. Whenever this one becomes actually vacant, the claims of Jared Hand may be considered with those of other competitors. "THOMAS JEFFERSON."

In a matter respecting the conduct of the keeper of Cape Henry lighthouse he wrote:

"I think the keepers of light houses should be dismissed for small degrees of remissness, because of the calamities which even these produce; and that the opinion of Col. Newton in this case is of sufficient authority for the removal of the present keeper.

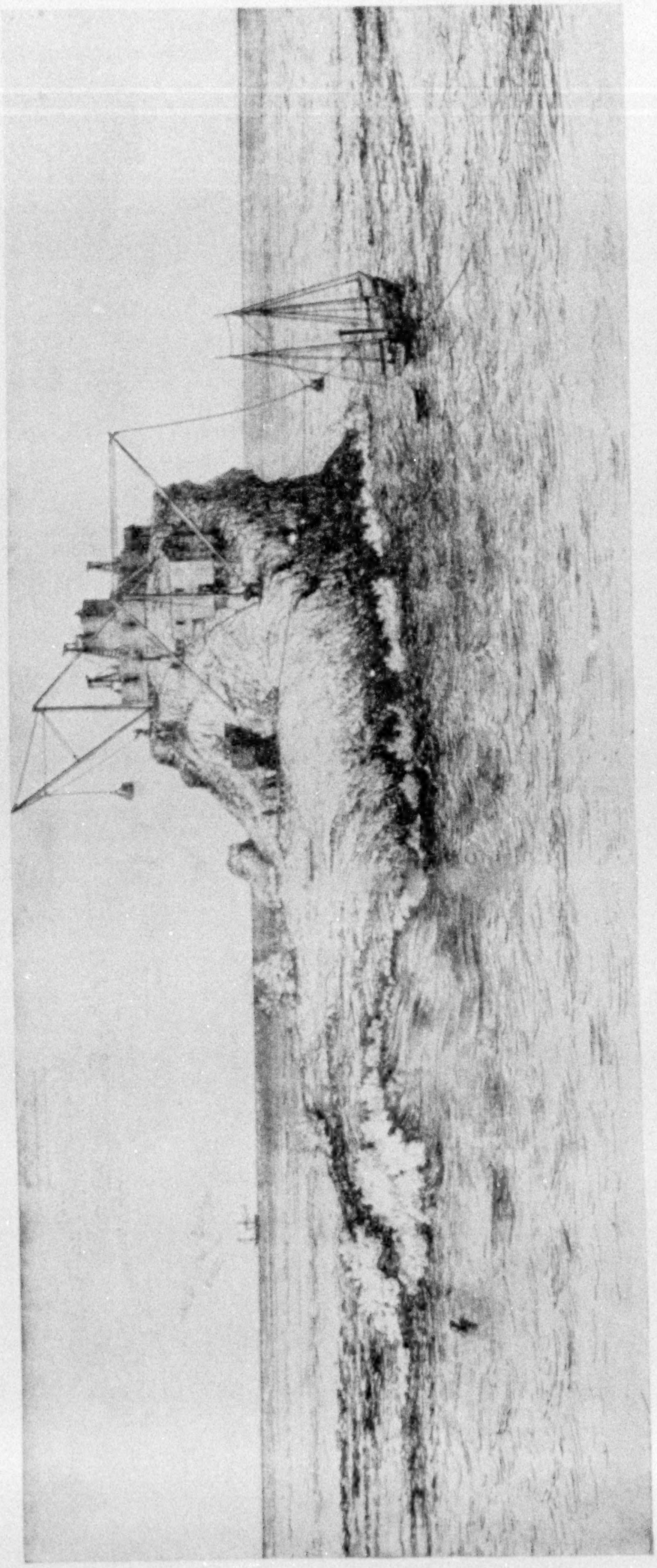
"Dec. 31, '06." "TH. JEFFERSON."

LOCATION AND CONSTRUCTION OF LIGHTHOUSES

The first-class light and fog-signal stations are located at the more prominent and dangerous points along the seaboard, and on a well-lighted coast such stations should be sufficiently close that a coasting vessel may always be in sight of a light. The smaller lights are placed to mark harbors, inside channels, and dangers. Along the navigable rivers numerous post lights are maintained to indicate the channels.

For New York harbor and immediate approaches alone 268 aids to navigation are required, including 46 shore lights, 2 light vessels, and 36 lighted buoys; there are 192 buoys of all classes and 37 fog signals, including sounding buoys.

A chart of New York harbor in 1737 shows not a single aid to navigation there at that time. One may imagine the difficulties of Henry Hudson when in 1609 he sailed into New York Bay in the *Halfmoon*. The diary says: "We found



BUILDING THE TILLAMOOK ROCK LIGHT STATION, OREGON

Open to the sweep of the Pacific Ocean and one of the most exposed stations in the world; completed in 1881 (see page 21)

it to have a very shoald barre before it;" and, again, "the mouth of that land hath many shoalds." Boats were repeatedly sent ahead to sound as the *Halfmoon* worked her way into the harbor and river.

The natural alterations in channels and coast lines, the progress of improvements, and the changes in the trend and character of commerce and shipping make numerous modifications necessary in the aids to navigation, so that this is a work that will never be complete while nature and man are active. During the past year notices have been published of about 1,600 distinct changes in aids to navigation maintained by the United States Lighthouse Service.

Among the lighthouses of the country may be found examples of great engineering skill and of dignified and simple design. Some of the tall lighthouse structures are of beautiful architecture, suited to the purpose, and set off by picturesque location on headland or rock overlooking the sea. The tower must be built to give the light a suitable height above the water, and hence tall lighthouses are required on low-lying coasts.

A light must be about 200 feet above the water to be seen from the deck of a

THE TILLAMOOK ROCK LIGHT COMPLETED

The seas here are terrific. On October 19, 1912, a wave broke a pane of the lantern 132 feet above the sea (see page 21)

vessel 20 nautical miles distant; beyond that distance the curvature of the earth would prevent a light at this elevation being seen. The light and lens are protected by an outer lantern of glass.

At the principal stations provision is made either in the tower or in separate buildings for the mechanical equipment connected with light and fog signal, for storage of oil and supplies, for quarters for keepers and their families, boats, etc.

Various materials have been employed in lighthouse construction—stone, brick, iron, steel, concrete, reinforced concrete, and wood; in new work, however, the latter is now little used because of the desirability of permanency.

The Lighthouse Service at present owns 1,186 distinct pieces of land; besides this, many lights stand in the water, and post lights along the rivers are on temporary sites not purchased.

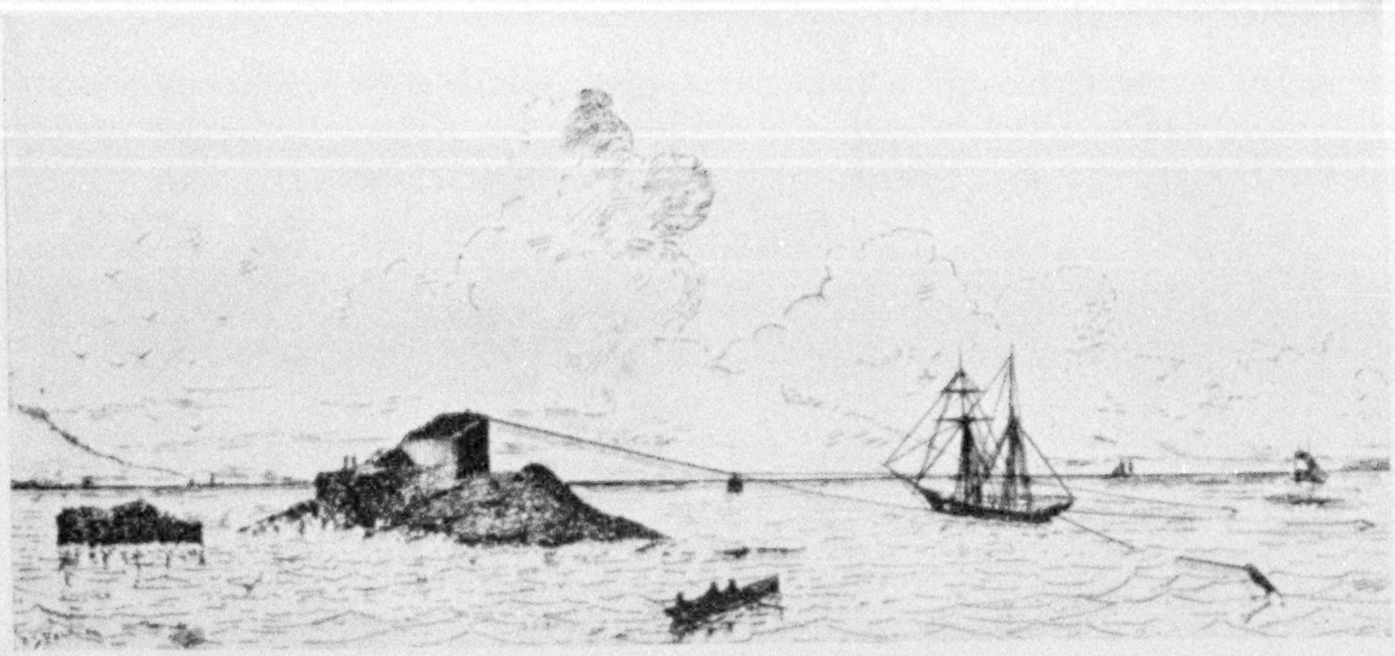
WONDERFUL SEA-SWEPT LIGHTHOUSES

Lighthouse construction on the land is usually comparatively simple, except when there is difficulty of access to the site. But often it is important for the protection of shipping that lighthouses be erected either on rocks or reefs exposed to the sea or actually in the water, on sand or rock bottom. Such work has called forth the greatest skill of engineers.

Numerous types of construction have been used. Where the foundation is exposed, even at the lowest tides, masonry towers have been, with great labor and often danger, fitted to the bed-rock; otherwise the structure has been erected on iron piles driven, screwed, or pumped into the sand or coral, or on caissons floated to the site and set on the bottom or sunk deeper by the pneumatic process, or by the use of coffer-dams, within which the masonry tower has been erected; smaller structures have been placed on rip-rap foundations.

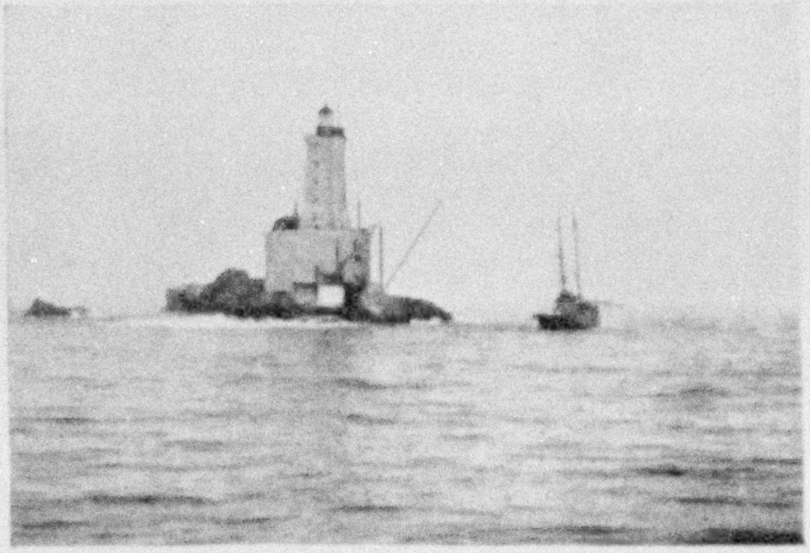
The earliest example now existing of a sea-swept lighthouse is the beautiful tower of Cordouan, built in 1584 to 1611, on a rock in the sea at the mouth of the Gironde, on the west coast of France. This lighthouse has since been altered and raised in height. The original structure was elaborately decorated, and one floor was occupied by a chapel (see page 8).

The most famous of the sea-swept lighthouses is the Eddystone, 13 miles from Plymouth harbor, England. This was completed in 1699, after four years of work. During the first year all that was accomplished was drilling 12 holes in the rock and fastening irons in them. This lighthouse, with the keepers and the engineer who built it, disappeared in the great storm of November, 1703, and since



BUILDING THE LIGHTHOUSE ON ST. GEORGE REEF, CALIFORNIA

The rock is so exposed that the workmen were obliged to live in the schooner, moored beside the rock, and were carried back and forth by a traveler on a cable (see page 23)



ST. GEORGE REEF LIGHT, CALIFORNIA, COMPLETED: A DIFFICULT AND EXPENSIVE STRUCTURE

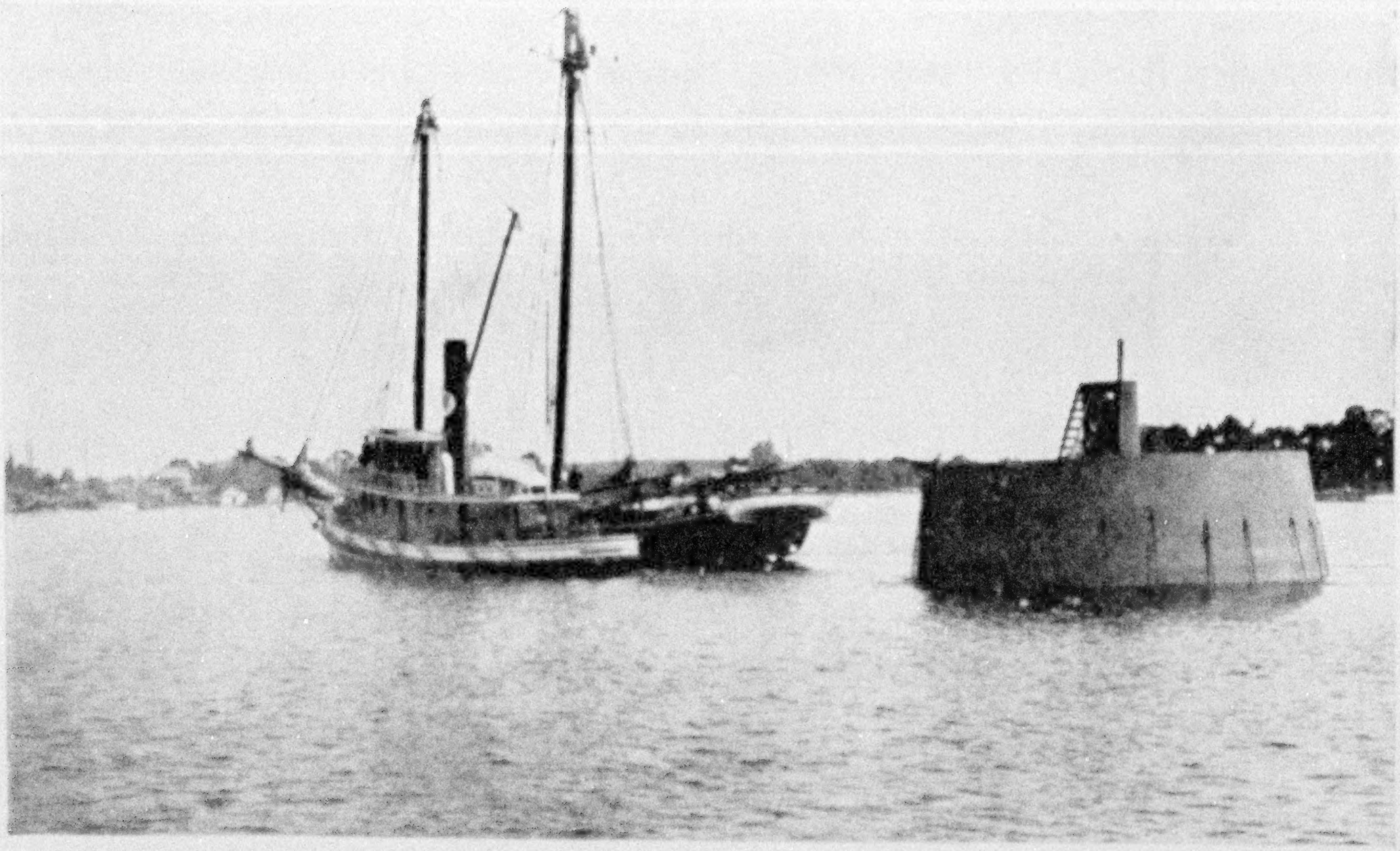
that time three other lighthouses have in succession been erected on the Eddystone (see pages 12-13).

MINOTS LEDGE LIGHT

The earliest lighthouse built in this country in a dangerous position, exposed to the open ocean, was that on Minots Ledge, a reef off Boston harbor which had long been a terror to mariners. This was an open-work iron-frame structure, supported on wrought-iron piles wedged into holes 5 feet deep, drilled in the rock, which was bare only at low water. It was completed in 1848 (see page 14).

There was a great gale in April, 1851. "The light on the Minot was last seen from Cohasset on Wednesday night at 10 o'clock. At 1 o'clock Thursday morning, the 17th, the light-house bell was heard on shore, one and one-half miles distant; and this being the hour of high water, or rather the turn of the tide, when from the opposition of the wind and the tide it is supposed that the sea was at its very highest mark; and it was at that hour, it is generally believed, that the light-house was destroyed; at daylight nothing of it was visible from shore, and hence it is most probable it was overthrown at or about the hour named." Two keepers were in the tower and were lost, and this extract from the official report tells the story of one of the great lighthouse tragedies.

The present massive stone lighthouse was built on the same site on Minots Ledge, commenced in 1855 and completed in 1860. It ranks among the difficult lighthouse engineering works of the world. During the first summer only 130 working hours were obtained on the rock, and after three years' work only four stones of the foundation were laid. The reef rock was prepared to fit the stones of the lower courses and the latter were



A TUG TOWING A CAISSON TO BE SUNK FOR A LIGHTHOUSE FOUNDATION (SEE PAGES 20 AND 26)

cut to interlock. Dwellings for the keepers' families were built on the shore, accommodations for the men only being provided in the tower.

Longfellow visited Minots light in 1871, and in a letter thus describes it: "The lighthouse rises out of the sea like a beautiful stone cannon, mouth upward, belching forth only friendly fires."

SPECTACLE REEF AND STANNARD ROCK

Spectacle Reef lighthouse, built on a reef near the northern end of Lake Huron, is a stone tower standing in a depth of 11 feet of water, 10 statute miles from land. It is in a position exposed to heavy ice action. A coffer-dam was constructed at the site, the water was pumped out, the bed-rock was leveled off, and the lighthouse was constructed of cut stone, securely fastened. It was completed in 1874, and is a notable engineering work. The first year it was well tested by the ice. When the keepers returned to the tower in the spring of 1875 they found the ice piled against it to a height of 30 feet. As this was 7 feet above the doorway, they had to cut through the ice to enter.

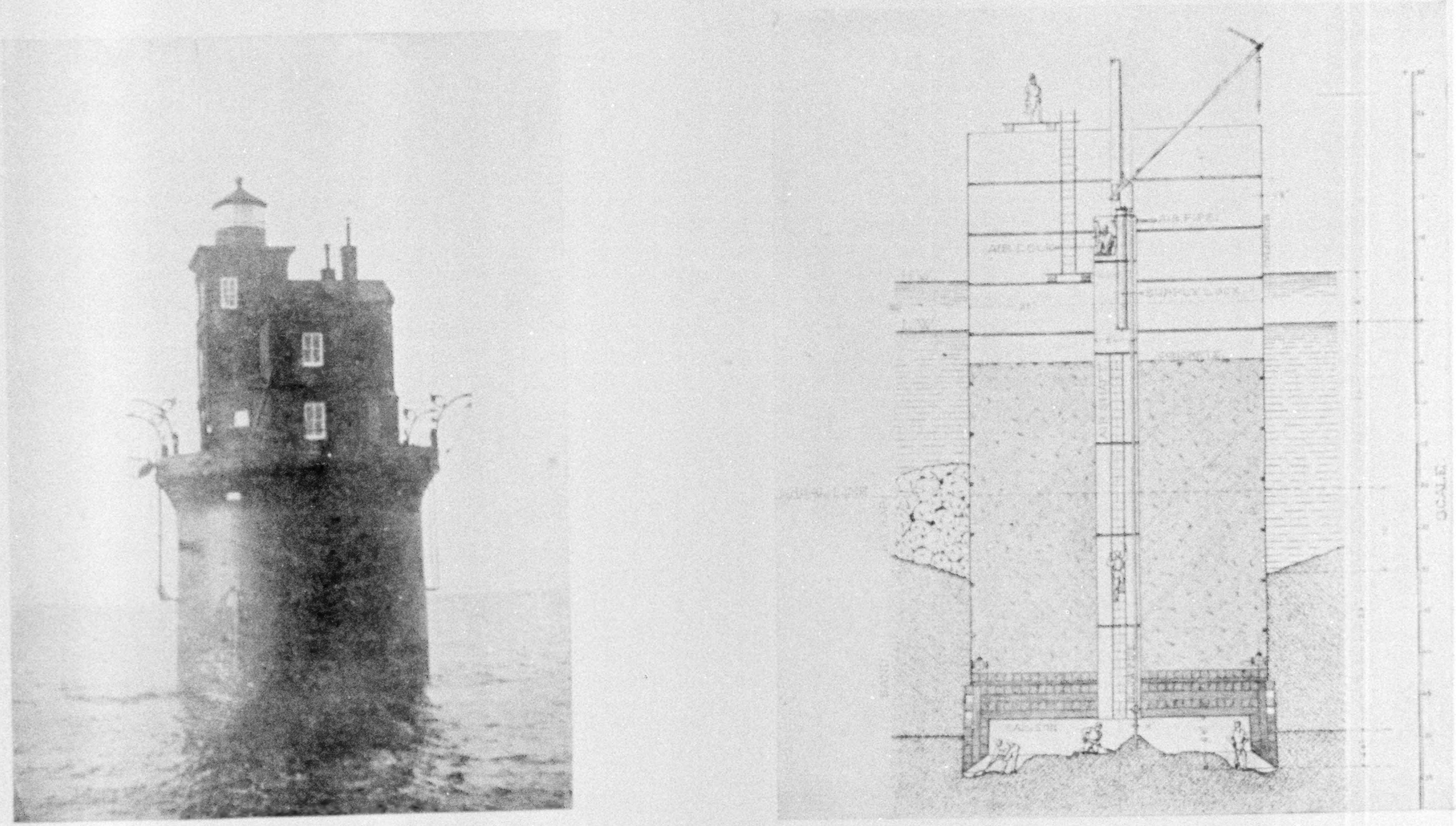
Stannard Rock light, 24 statute miles from the nearest land and marking the most dangerous reef in Lake Superior, is the most distant from shore of any lighthouse in this country. It was completed in 1882, constructed in a manner similar to that on Spectacle Reef, and stands in the same depth of water—11 feet (see page 15).

WHITE SHOAL LIGHT

White Shoal, a dangerous spot in Lake Michigan, at the entrance to the Straits of Mackinac, was marked for 19 years by a light vessel anchored over it. On account of the ice, this vessel could not be kept on the station during a portion of the season of navigation in the spring and fall. As the unmarked shoal was a serious menace to navigation at these seasons, an appropriation was made for building a lighthouse, and this was completed in 1911 at a cost of $225,000.

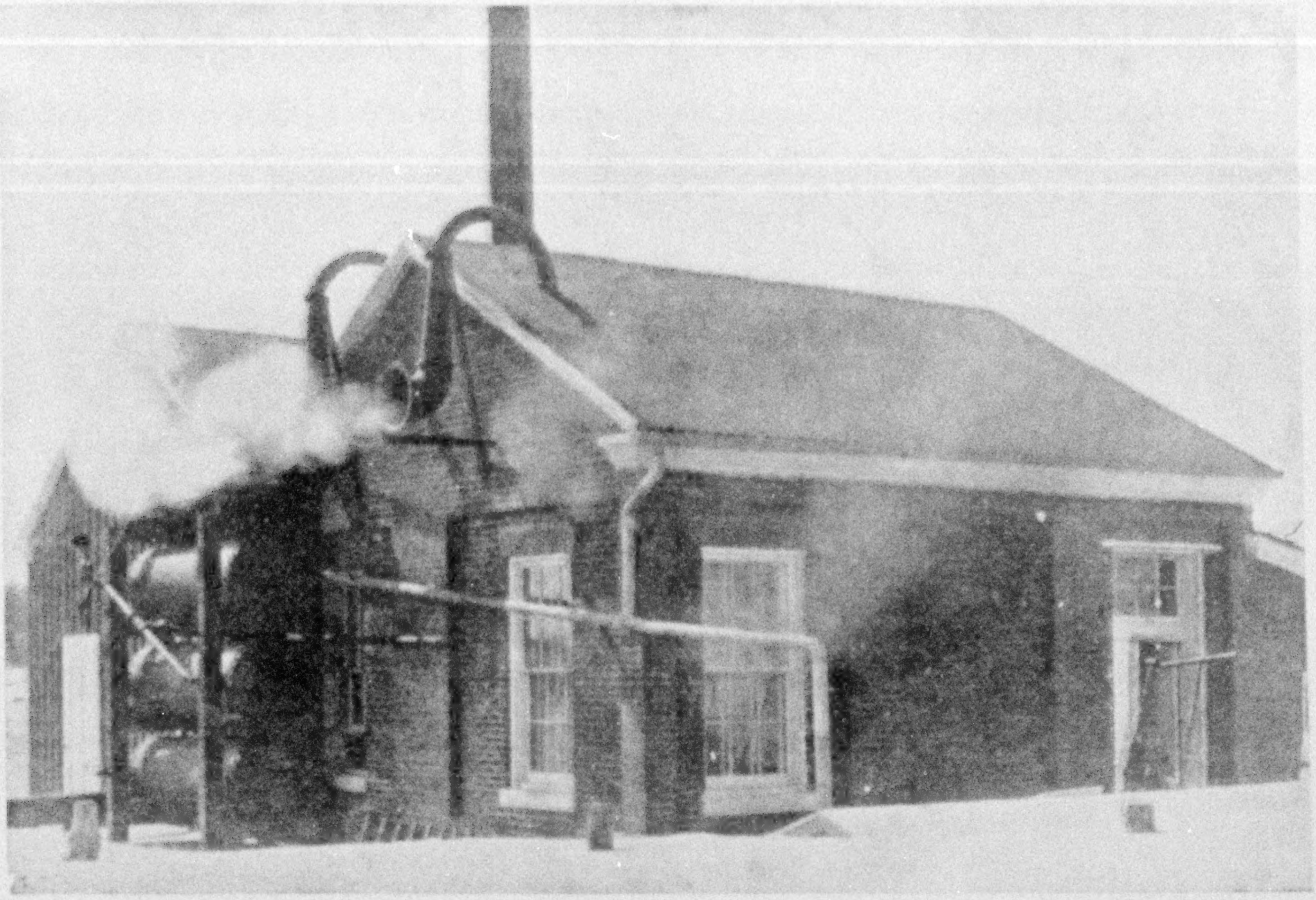
A timber crib 72 feet square and 18 feet high was built on shore and floated out to the site, where the depth of water was 22 feet. The bottom, which is of coarse gravel, was covered with 2 feet of rock, and the crib was filled with stone and sunk. Above this was built a concrete pier, which supports the lighthouse.

XUM


AIR PIPE
AIR LOCK
SUPPLY LOCK
CONCRETE
AIR SHAFT
SCALE

THE 14-FOOT BANK LIGHTHOUSE, DELAWARE

The first lighthouse in this country, the foundation of which was placed by pneumatic process. Completed in 1887. The diagram shows men working in the caisson under air pressure removing the sand, which is blown out (see page 26)



CAPE HENRY FOG SIGNAL, VIRGINIA

This fog signal is an air siren driven by oil engines. The trumpets are curved downward to prevent sand drifting into the sirens. "The fog signals now in use in the United States consist of sirens, whistles, reed trumpets, aerial bells, and submarine bells. Sirens and whistles are operated by compressed air or steam, and trumpets by compressed air. To furnish air, compressors driven by internal combustion engines are used, and for steam signal boilers are employed. The larger fog bells, up to 4,000 pounds, have hammers actuated by a weight and clockwork" (see page 47).

The light is of 1,200,000 candle power, flashing white every 8 seconds. In addition to the compressed air fog-whistle there is a submarine bell signal, located in 60 feet of water three-quarters of a mile from the station. This bell is supported on a tripod standing on the bottom of the lake, is operated by electric power transmitted through a cable from the light station, and strikes "23."

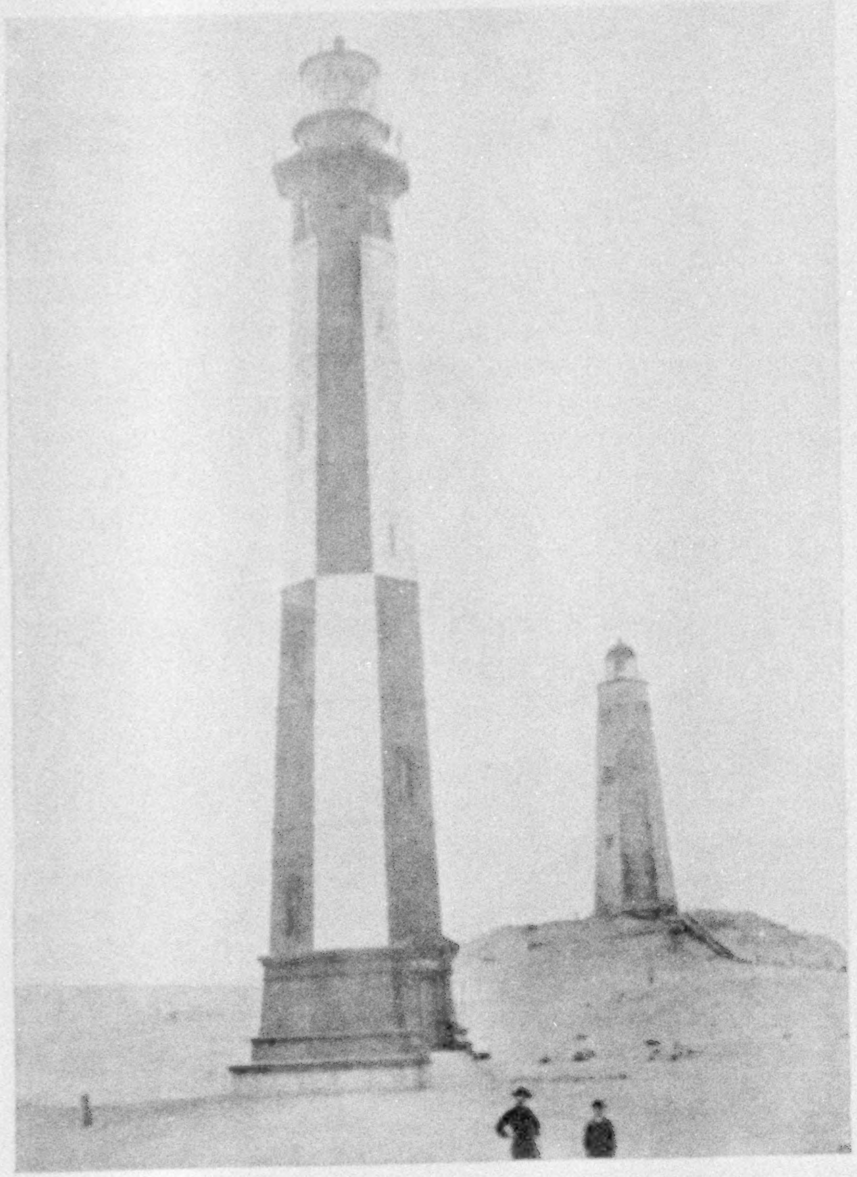
TILLAMOOK ROCK—ONE OF THE MOST EXPOSED IN THE WORLD

Two lighthouses involving great difficulties have been built on rocky islets off the Pacific coast—Tillamook Rock, completed in 1881, and St. George Reef in 1891. Tillamook is a high, precipitous rock south of the Columbia River and about a mile from shore. It is exposed to the sweep of the Pacific Ocean. Landing on the rock was very dangerous, and the foreman was drowned the first day a working party was landed. There was serious difficulty in providing any protection on the rock for the workmen. It was necessary to blast off the top of the rock to secure sufficient room for the lighthouse (see pages 16-17).

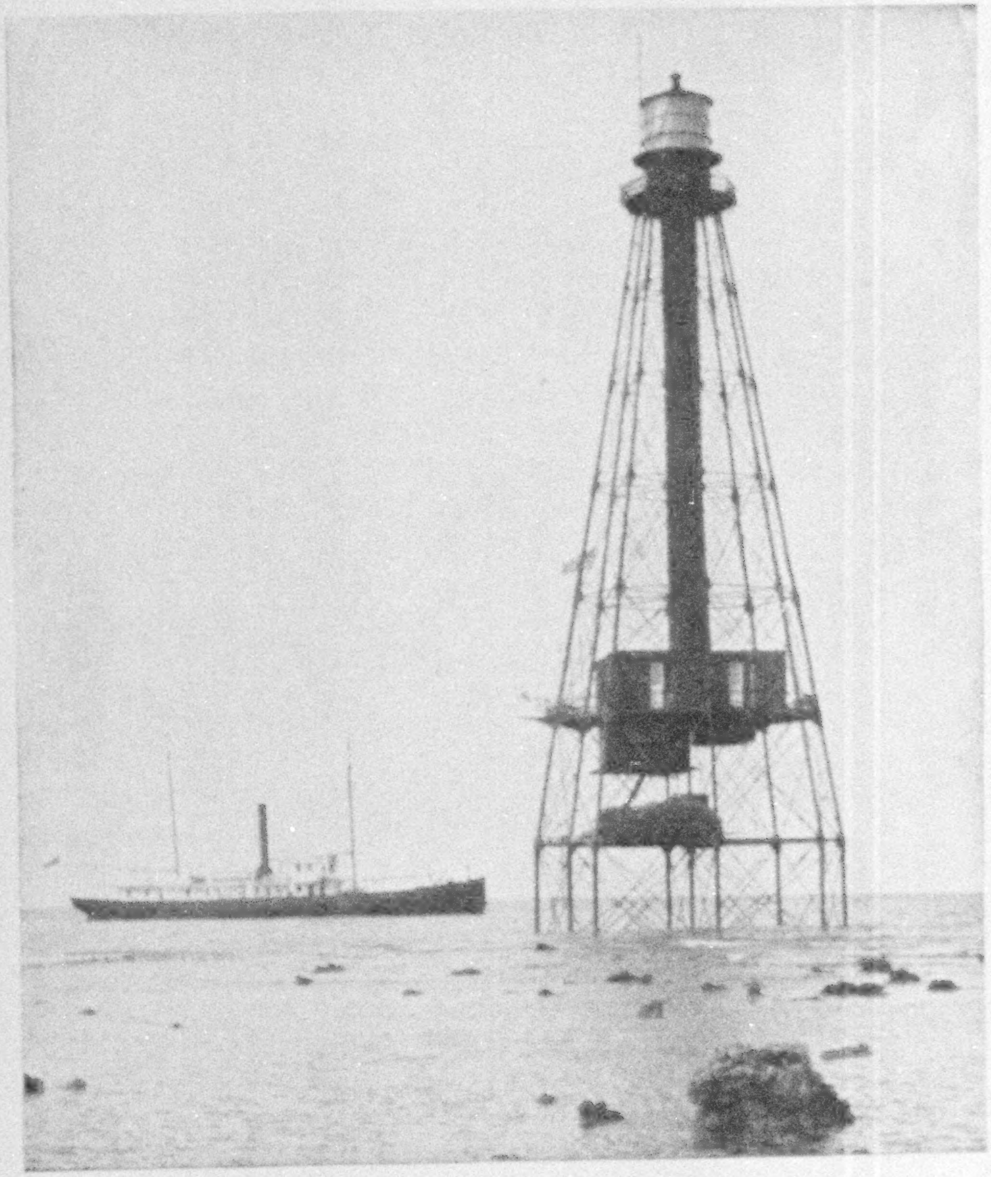
This light station is one of the most exposed in the world. The tower is 136 feet above high water, but the keepers reported that in a storm in 1887 the seas broke over the building, some going above the tower, and serious damage was done. In another storm *a mass of concrete "filling weighing half a ton was thrown over the fence into the enclosure," at a level of 88 feet above the sea.*

Here is the keeper's report of a storm in October, 1912, at Tillamook light. The lighthouse tender, on account of weather conditions, was not able to reach the rock for 7 weeks after this storm:

"I regret to state that on the evening of the 18th, or morning of the 19th, we lost a portion of the west end of the Rock, water and rocks coming over with so much noise we could not tell when, and did not know it had departed before

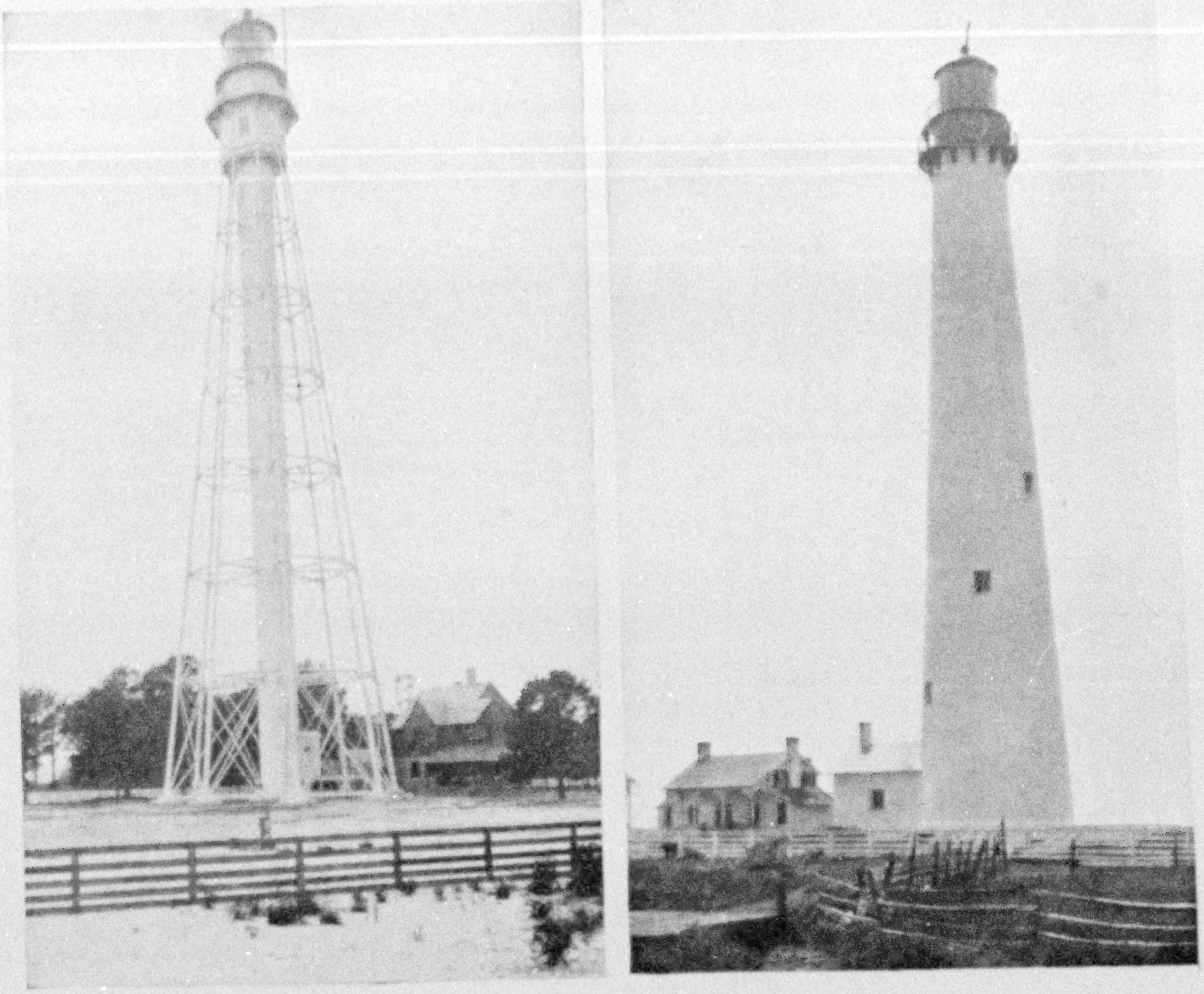


THE PRESENT LIGHTHOUSE AND THE OLD ABANDONED LIGHTHOUSE AT CAPE HENRY, VIRGINIA
(SEE PAGE 27)



SOMBRERO KEY LIGHT, FLORIDA

A pyramidal iron skeleton tower, supported on iron piles driven into the coral reef. The keepers live in the house (see page 25)



THE OLD AND THE NEW LIGHT TOWERS AT CAPE CHARLES, VIRGINIA

The tower on the right was built in 1864, but was abandoned in 1895, as the site was destroyed by erosion of the sea. The previous tower, built in 1827, had been discontinued in 1863 for the same reason. The new tower, shown on the left, consists of an iron cylinder surrounded by iron framework (see page 28).

next morning when the sea went down so that we could go outside.

"At 12:35 a. m. on the 19th the sea came up and broke one pane in of the middle section of the lantern (132 feet above the sea), which also put the light out and flooded the watch-room, as well as down-stairs. To add to it all the soot and ashes came out of the stove in the kitchen.

"At 12:50 a. m. we had the light burning and storm pane in for the rest of the night.

"Siren was running until the crash came, but making no regular blast on account of the water filling the trumpet too fast. After getting the light burning we closed down the fog signal, as the wind hauled to westward and cleared the atmosphere somewhat. Shortly afterward when taking siren out to clear it I found it filled partly full with rocks; therefore the water could not get out of it (siren horns are 95 feet above the sea).

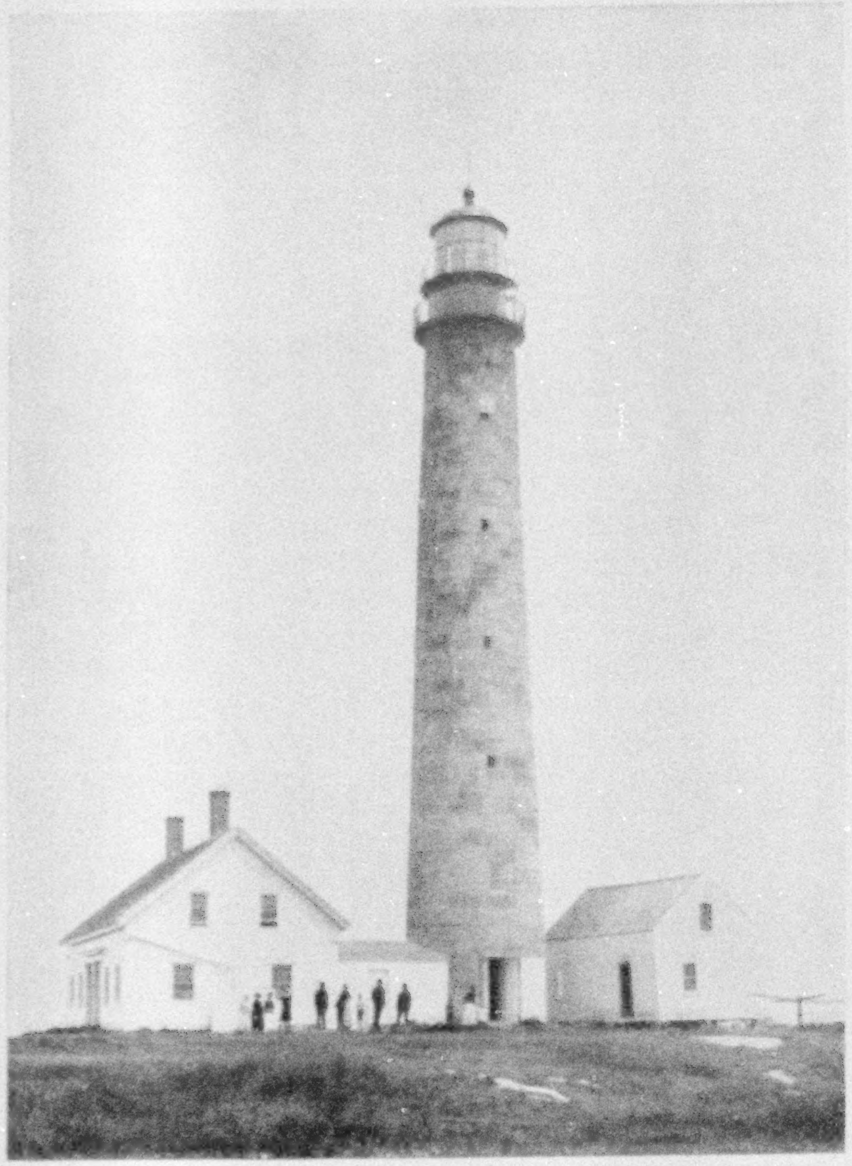
"Will also state that every one under my charge worked hard and faithfully, regardless of water and glass, everybody being drenched to the skin."

Before the location of the lighthouse, this rock had been a favorite resort of sea lions, who completely covered its slopes; these at first were hostile and disposed to object to other use of the rock, but finally retired to other resorts.

ST. GEORGE REEF LIGHT, CALIFORNIA

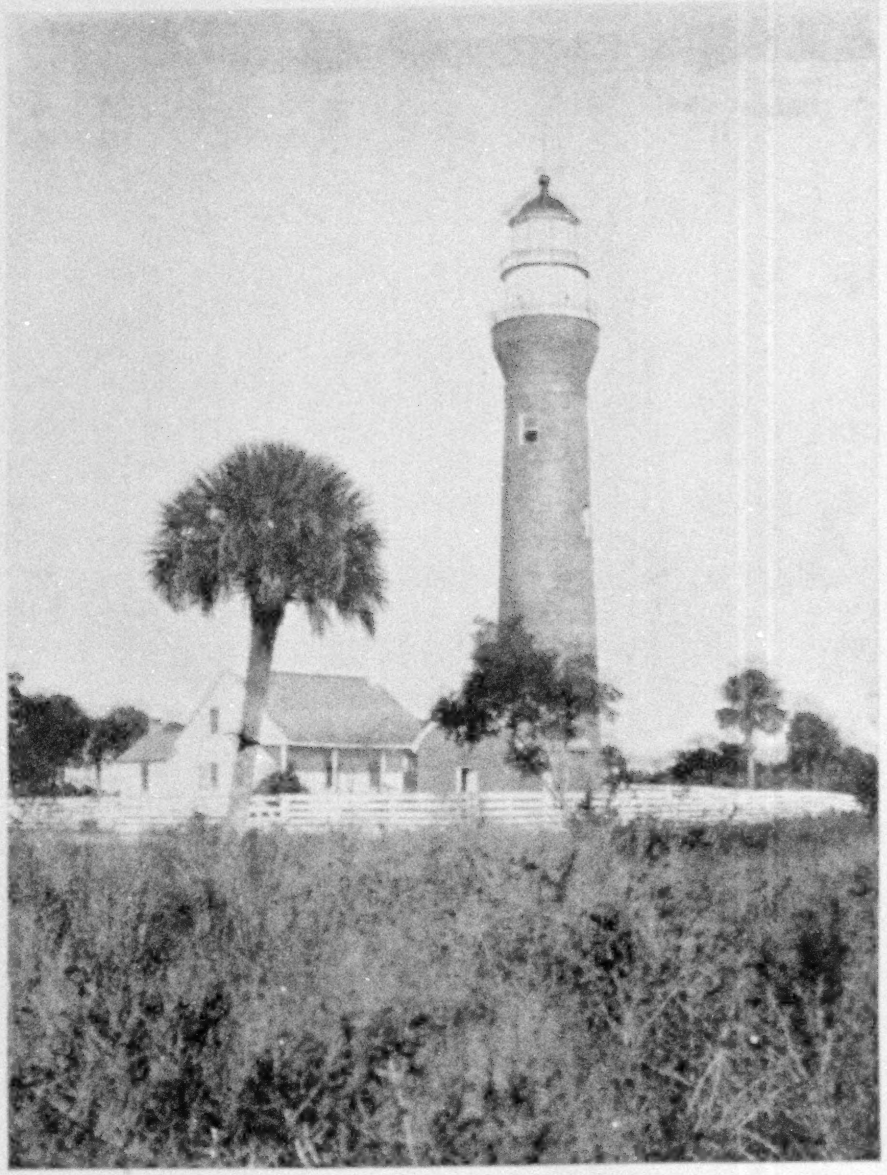
St. George Reef light is built on a rock lying 6 miles off the northern coast of California. The rock was so exposed and swept by the seas that workmen could not safely live upon it, and it was necessary to moor a schooner near the rock to provide quarters for the men, who were transported back and forth by

XUM



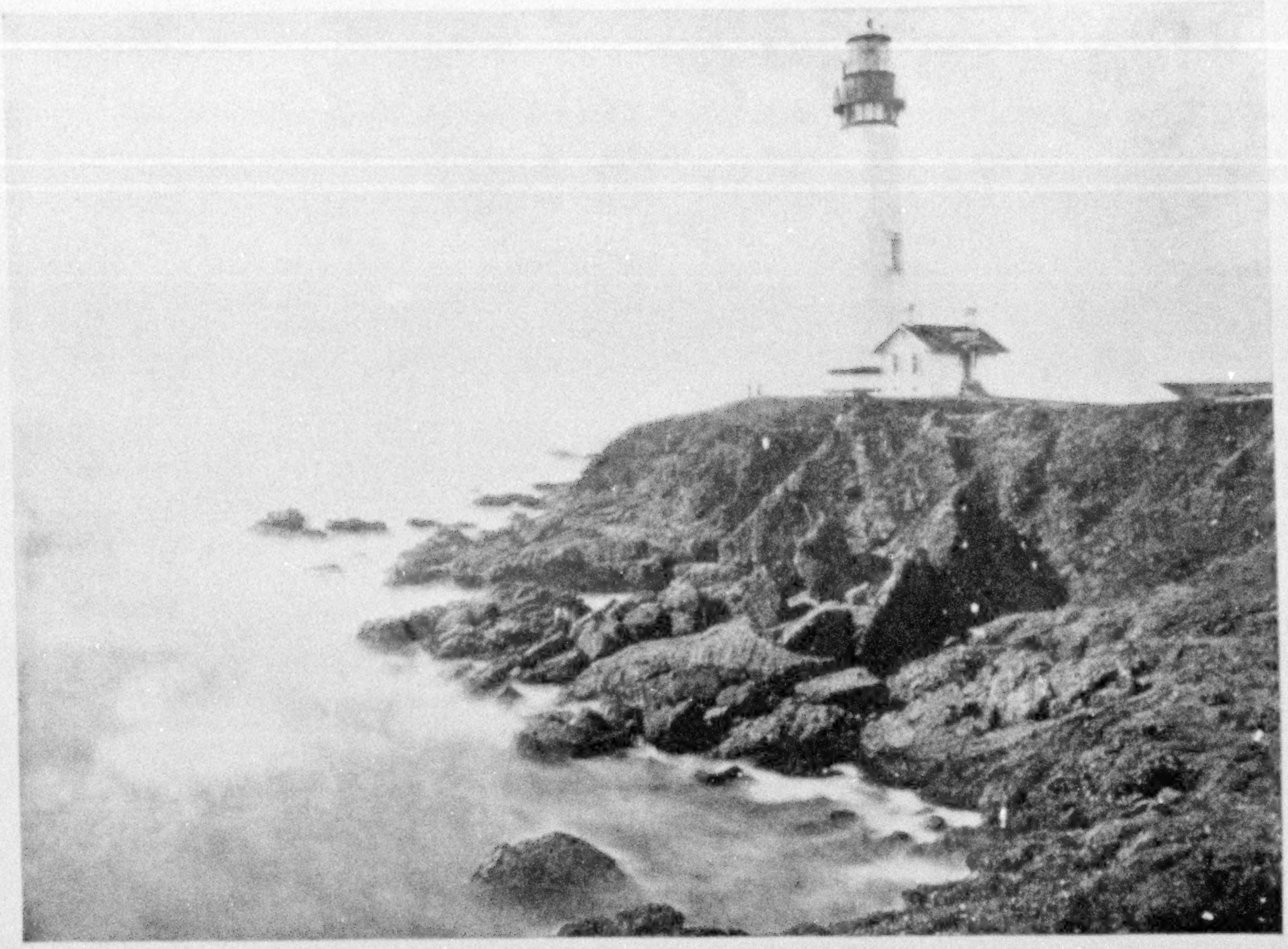
THE PETIT MANAN LIGHTHOUSE, MAINE

A granite tower, 115 feet high. The light is white, fixed and flashing, showing a steady light for 1 minute, and a 5-second flash in the next minute. The fog signal is a steam whistle giving each minute two blasts of 5 seconds each.



THE ST. JOHNS RIVER LIGHT, FLORIDA

A brick lighthouse at the entrance to St. Johns River. A fixed white light, without fog signal. This light was recently changed from an oil wick lamp to an incandescent oil vapor lamp, increasing the candle power from 860 to 13,000.



THE PIGEON POINT LIGHTHOUSE, ON THE RUGGED PACIFIC COAST, CALIFORNIA

This light gives each 10 seconds a flash of 4 seconds' duration and 160,000 candle power. The fog signal is a first-class air siren, giving each 30 seconds two blasts in quick succession

a traveler on a cable. The total cost of the work at St. George Reef was about $712,000, making it the most expensive lighthouse that has been built in this country. These two exposed light stations on the Pacific coast are the only ones having five keepers (see pp. 16-18).

Of lighthouses built on piles in the water, the original Minots Ledge structure has been mentioned. Brandywine Shoal light, in 6 feet of water in Delaware Bay, completed in 1850, was the first in the United States built on iron screw-piles. These were bored down 6 feet into the sand bottom, the broad screws at the ends of the piles also furnishing additional bearing surface; this structure has stood 62 years, but now must be rebuilt on account of the piles having been damaged by the ice.

LIGHTS ON THE FLORIDA REEFS

Five pyramidal iron skeleton lighthouses have been built in the water along the Florida reefs; these are supported on iron piles forced about 10 feet into the coral rock or sand. The piles are driven through large cast-iron discs, with a shoulder bearing on the disc; these discs are about 8 feet in diameter and give a broad support for the structure.

Sombrero Key, with its light 142 feet above the sea, is the tallest of these reef lighthouses (see page 22). The keepers' quarters are carried within the skeleton tower, and they thus live 37 feet above the water.

LIGHTS ON SAND BOTTOM—THE 14-FOOT BANK LIGHT

The first lighthouse built in the sea distant from the land and not on a rock foundation was the Rothersand. This notable engineering work stands in 20 feet of water, on a sand foundation, in the North Sea, 10 miles from the German coast, in the approach to Bremen. The first attempt to place a lighthouse in this position resulted in failure, but a structure was finally completed in 1885.

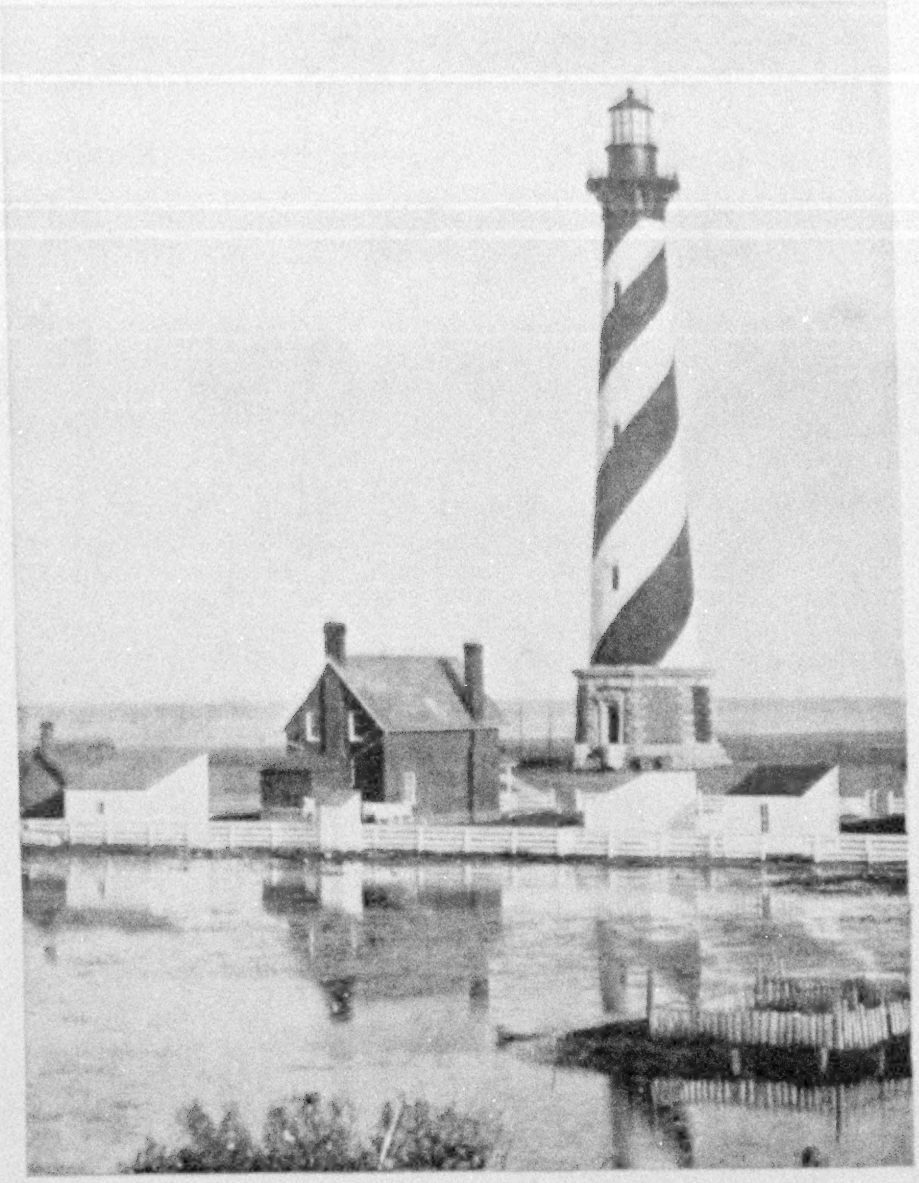
A POST LIGHT ON THE MISSISSIPPI RIVER

Post lights are maintained on about 5,500 miles of rivers in the United States

A caisson of boiler iron 36 feet wide, 46 feet long, and 61 feet deep was built in port. This caisson was towed to the site and sunk in position. Eight feet above the lower or cutting edge of the caisson was a diaphragm, forming a working chamber, from the center of which rose a cylindrical shaft with an airlock. The caisson was sunk by the pneumatic process to a depth of 73 feet below low water, the sand being removed from the working chamber by a sand blast; the caisson was filled with concrete and masonry and the light-tower erected on this foundation.

Two years later, in 1887, the first lighthouse in the United States built on a submarine foundation and sunk in a sand bottom by the pneumatic process was completed on Fourteen-foot Bank, Delaware Bay, in 20 feet of water. A timber working chamber 40 feet square was built, with cutting edge 7 feet deep. On this was placed an iron cylinder 35 feet in diameter and 18 feet high, built of cast-iron plates bolted together by their flanges. This was towed to the site and placed in position. It was sunk, by digging and blowing out the sand, to a depth of 33 feet below the surface of the shoal, the cylinder being built up until it was 73 feet high and filled in with concrete (see page 20).

Cast-iron cylinders have been used also on other shallow submarine sites affording stable foundations or on rocks nearly awash. Wooden cribs floated to the site have been similarly employed, an example of which is Detroit River lighthouse. Recently reinforced concrete caissons have been used, sunk in place on the bottom, for minor light stations.



THE TALLEST LIGHT TOWER OF THIS COUNTRY, 200 FEET HIGH: THE CAPE HATTERAS LIGHTHOUSE, NORTH CAROLINA

The spiral painting is to furnish a distinctive day-mark to mariners. "A light must be about 200 feet above the water to be seen from the deck of a vessel 20 nautical miles distant; beyond that distance the curvature of the earth would prevent a light at this elevation being seen."

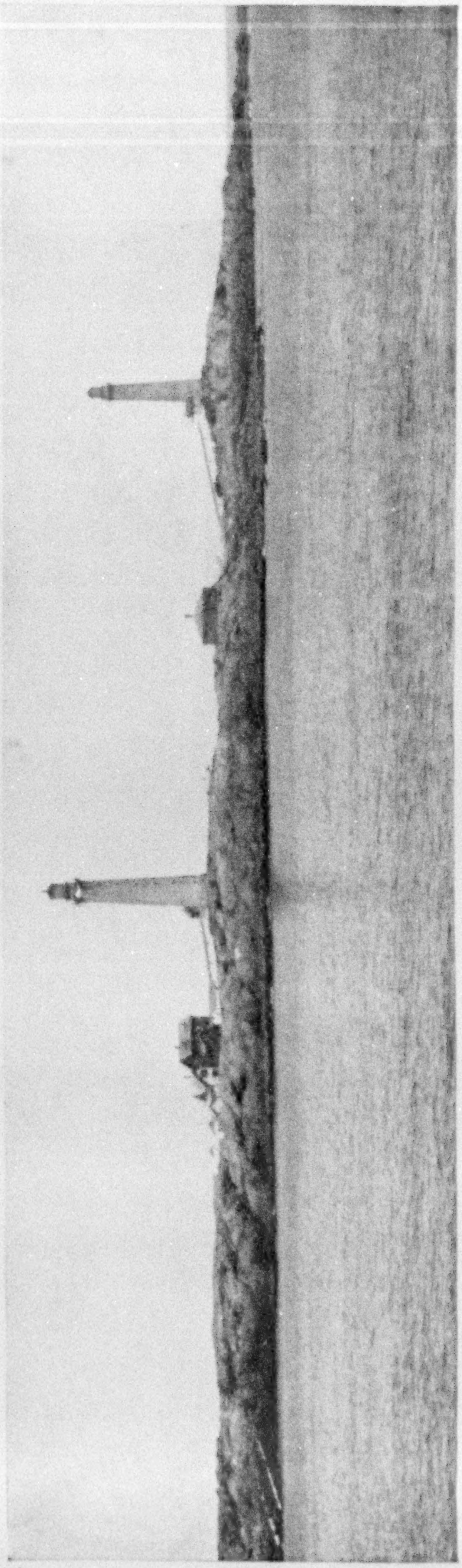
FAMOUS SHORE LIGHTS

Cape Henry lighthouse, at the entrance to Chesapeake Bay, is an example of an iron tower built with cast-iron plates bolted together along their flanges. The old tower at Cape Henry, abandoned in 1881, was the first lighthouse built by the United States government, being completed in 1791. There is a letter dated December 18, 1789, from Governor Randolph of Virginia to President Washington, saying: "The State some years ago placed upon the shore at Cape Henry nearly a sufficient quantity of materials to complete such a lighthouse as was at that time thought convenient, which have been in the course of time covered by sand. Measures are taking to extricate them from this situation," and offering to sell the materials and cede the necessary land to the United States (see page 22).

Petit Manan lighthouse, Maine, is a granite tower 115 feet in height. On Thatcher Island, at Cape Ann, Massachusetts, are two handsome granite light-towers, each 124 feet in height. St. Johns River light, Florida, is of brick, 80 feet high (see page 24).

The tallest light-tower in the United States is that at Cape Hatteras, on the low-lying coast of North Carolina, which is 200 feet from base to top of lantern. The highest light, however, is that at Cape Mendocino, on the coast of California, which is shown 422 feet above high water; it is on a cliff, the lighthouse itself being only 20 feet in height (see pages 27 and 29).

The main channel range for the harbor of Charleston, South Carolina, is composed of two stations of historic interest, the front-range light being on Fort Sumter and the rear light in the beautiful spire of St. Philips Church (see page 30).



THE TWIN LIGHTS OF CAPE ANN, MASSACHUSETTS

Two granite towers, originally built in 1789. The two fixed lights were established to furnish a distinctive aid, a purpose which now would be attained by a single flashing light (see pages 27 and 37)

LIGHTHOUSE DISASTERS AND PERILS

Many are the vicissitudes and tragedies that are connected with lighthouse history. Mention has been made of the destruction by storm of the first Eddystone and the first Minots Ledge lights, with the loss of all the keepers, and of the fact that the first Boston light was burned and finally blown up, incident to the operations of war (see pages 4 and 7).

The danger of fire is great. There is a quaint report by Jesse Tay, inspector of customs, of the burning on November 7, 1792, of Tybee lighthouse, the first built in Georgia: "About 2 o'clock in the morning the negro that trimed the lites went up to trim them and he discovered the lanthorn in flames he cry'd out the litehouse was on fier i jump'd up and run up Stairs . . . the glass and sinders was fawling so thick and it was so very hot i was not able to tarry half a moment and i saw it was in vain to attempt to save it."

Lighthouses are sometimes undermined by the encroachment of the sea. From this cause three successive towers have been built at Cape Charles, Virginia. The first was constructed in 1827, 700 feet from the then shoreline; this was abandoned in 1863, and the whole site has now been washed into the sea.

The second was built in 1864, also about 700 feet from the shore, but the sea continued to encroach until this now stands on the edge of the water.

The present lighthouse was built in 1895, about 3,600 feet from the shore, and is an iron cylinder 9 feet in diameter, surrounded and braced by an iron framework. This light flashes "45" every minute, four flashes in succession, followed by an eclipse, and then five flashes (see page 23).

Hunting Island lighthouse is a tower of cast-iron plates, built in 1859, about a quarter of a mile from the sea, on the coast of South Carolina. On account of the sea cutting away the end of the island, its position became unsafe, and in 1889 the lighthouse was taken down and reerected on a new site 1¼ miles distant.

Sand Island lighthouse, with keepers' dwelling, was built on a sand island at the entrance to Mobile Bay, Alabama. The hurricane of September, 1906, carried disaster along the Gulf coast, and this telegram was received from the lighthouse inspector: "Sand Island light out, island washed away, dwelling gone, keepers not to be found." The tower remained, and one keeper had, fortunately, gone ashore, but the other keeper and his wife perished (see page 32).

Point Arena lighthouse, California, was wrecked by the great earthquake of April, 1906; it has been replaced by the first light-tower of reinforced concrete built in this country.

The foundation of Chandeleur light, on the coast of Louisiana, was undermined and the tower thrown out of plumb by a storm in October, 1893.

Thimble Shoal lighthouse, in Chesapeake Bay, was run into by a schooner recently, the structure broken, and the house and light destroyed by the fire which resulted. This is the second time the structure has been destroyed by fire, and it has been rammed a number of times by vessels and tows (see page 33).

THE CAPE MENDOCINO LIGHT, CALIFORNIA

This lighthouse is only 20 feet in height, but it stands on the edge of a cliff, and the light is 422 feet above the sea, the most elevated in this country.

TROUBLES FROM ICE, BIRDS, AND SAND

Winter seriously increases the work of maintaining aids to navigation: the spray or sleet freezing may completely envelop the tower in ice, obscuring the light until the lantern is cleared. In northern waters, where there is floating ice, many of the gas buoys must be removed in winter and replaced by spar buoys, over which the ice may pass without serious damage to the buoy. The spray freezes to bell buoys sometimes until the weight of the ice overturns them.

Most of the lighthouses on the Great Lakes are closed during the winter months, when general navigation ceases on those waters. There is risk to men and vessels in taking off the keepers in the winter gales at the close of navigation. In 1893 three lighthouses in Chesapeake Bay—Wolf Trap, Smiths Point, and Solomons Lamp—were swept away by the ice.

Sand creates difficulties at some light stations located among dunes or shifting wastes of sand. At Cape Henlopen the sand driven by the wind has cut deeply into the wood framing of the keepers' dwellings, and has ground the window glass so that it is no longer transparent; but the lantern of the light is too high to be so affected.

Even the flying birds make trouble at

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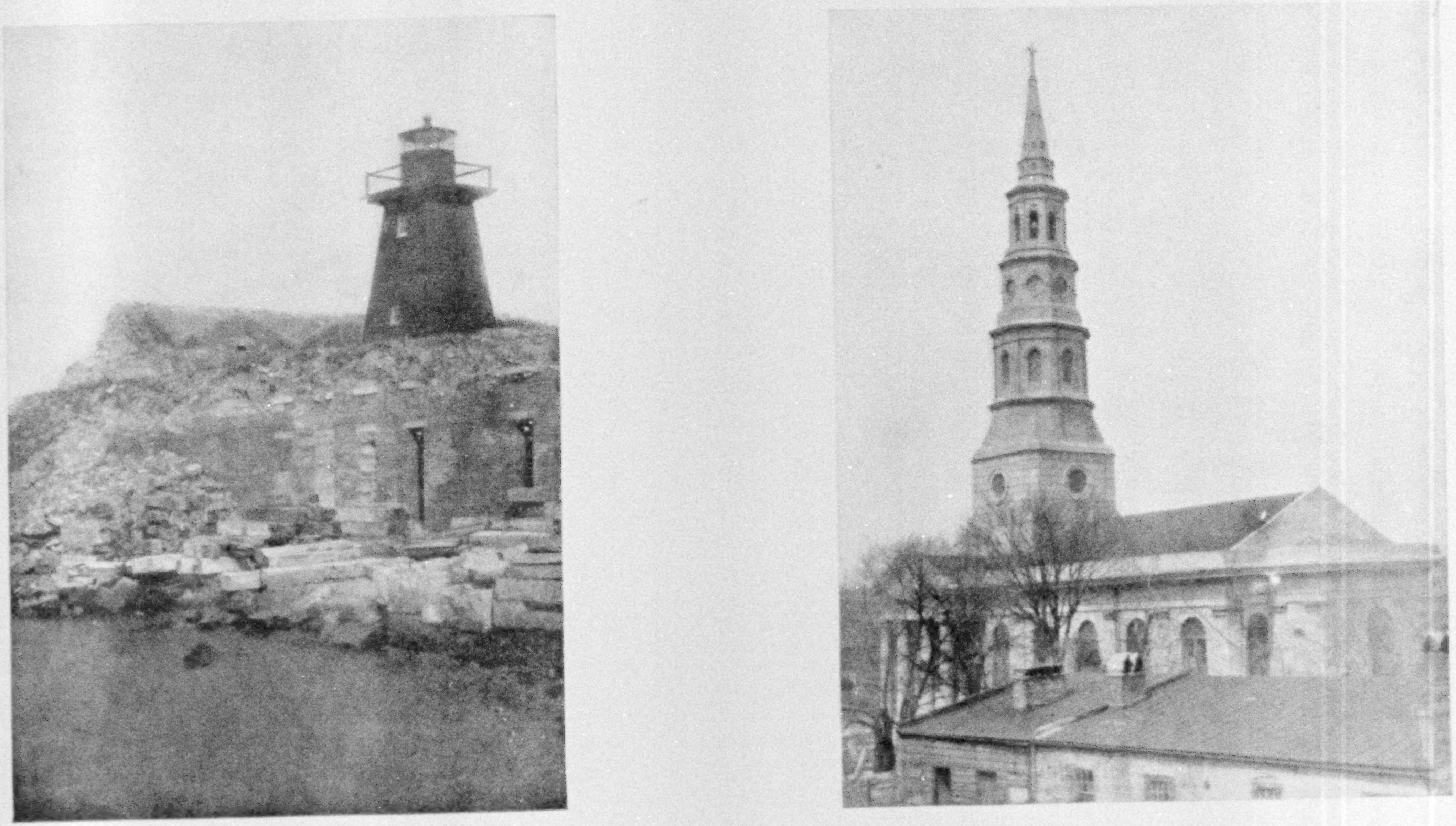
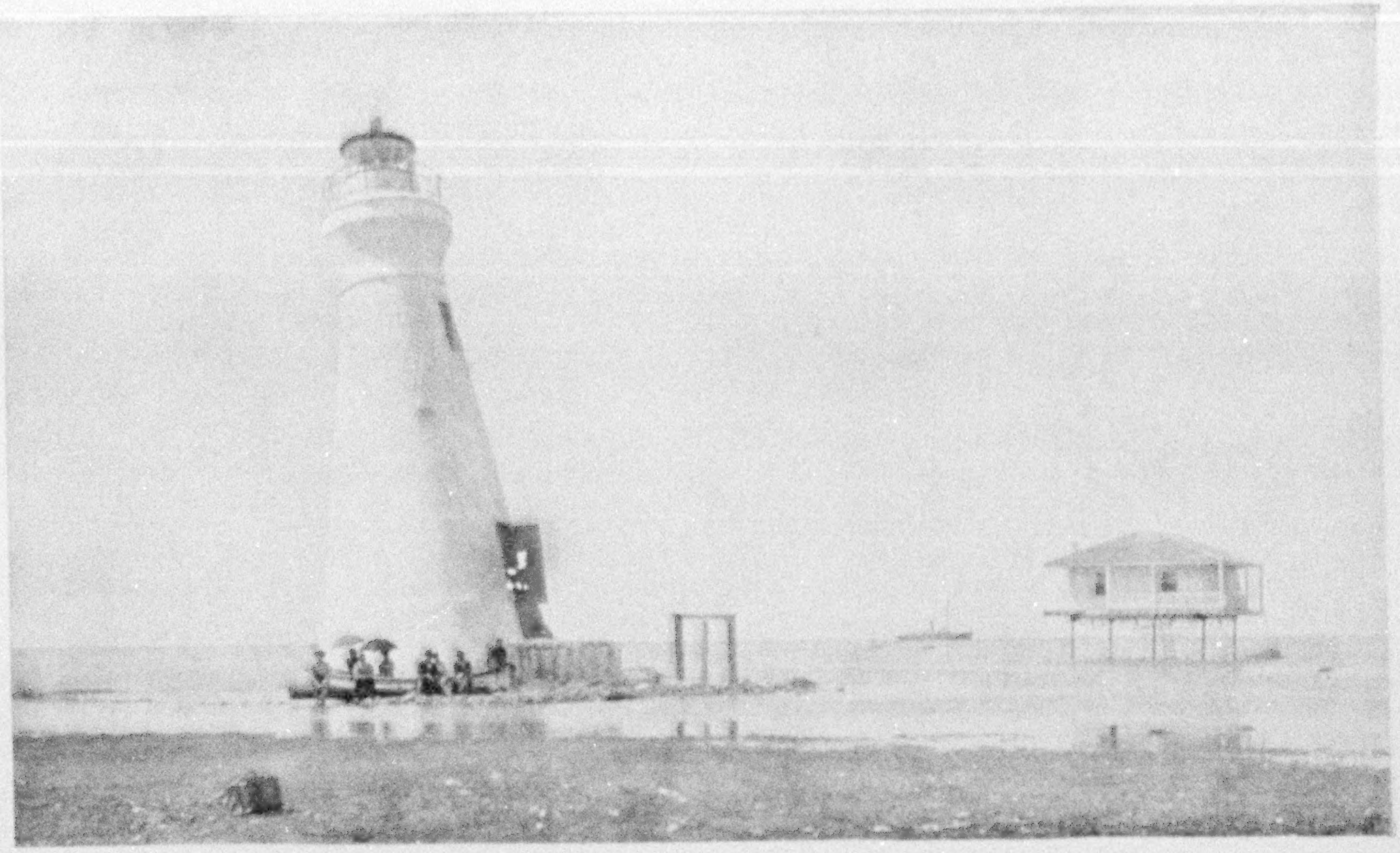


THE RANGE LIGHTS FOR CHARLESTON HARBOR, SOUTH CAROLINA

These two lights in line form a range for entering Charleston Harbor. Both are of historic interest—the front light on Fort Sumter and the rear light in the beautiful spire of St. Philips Church



THE CHANDELEUR LIGHT-TOWER, LOUISIANA, WHICH WAS ABANDONED AFTER BEING UNDERMINED BY A TORNADO IN 1893

lighthouses, as the brilliant light so attracts them that they will fly directly for it, and striking the heavy glass of the lantern are killed and fall to the ground. At Cape Charles light the keeper has seen ducks fly directly through the lantern and fall to the floor cut and torn by the broken glass. Some lighthouses are fitted with bird-protecting screens around the lantern, as for instance at Mayo Beach light on Cape Cod. When Sabine Bank light, in the Gulf of Mexico, was increased in brilliancy by installing an oil vapor lamp, a bird-guard was found necessary because of the birds flying for the lantern, attracted by the more brilliant light.

FROM WOOD FIRES AND CANDLES TO OIL VAPOR AND ELECTRIC LAMPS

The early lighthouses were lighted by wood or coal fires burned in open braziers, and later by candles inclosed in lanterns; the resulting light was necessarily weak and fitful, and a large part was lost by being diffused in directions of no use to mariners. A coal fire was burned at the Isle of May light on the coast of Scotland up to 1816, and the famous Eddystone was lighted with 24 wax candles to 1811. Oil lamps were early used in this country, if not from the first lighting of Boston light. Fish oil, sperm oil, colza oil, lard oil, and mineral oil were in turn burned, increasing expense in each case compelling a change. Circular wick lamps, with a central current of air, were invented by Argand in 1782.

At the present time lamps with from one to five concentric wicks, and burning a high grade of kerosene oil, are used in a majority of lighthouses. About 610,000 gallons of oil are burned each year at the light stations of the United States, about 340,000 gallons of which are for lighthouse illumination.

For the more important lights the incandescent oil vapor lamp is now used, having been introduced by the French in 1898. In this lamp the oil is heated and then vaporized, and is burned mixed with air under a mantle which is made incandescent. This gives a much more brilliant light than the wick lamp, with a smaller consumption of oil.

For instance, this change of lamps recently made at Cape Hatteras light has increased the brilliancy of the light from 34,000 to 160,000 candle power,

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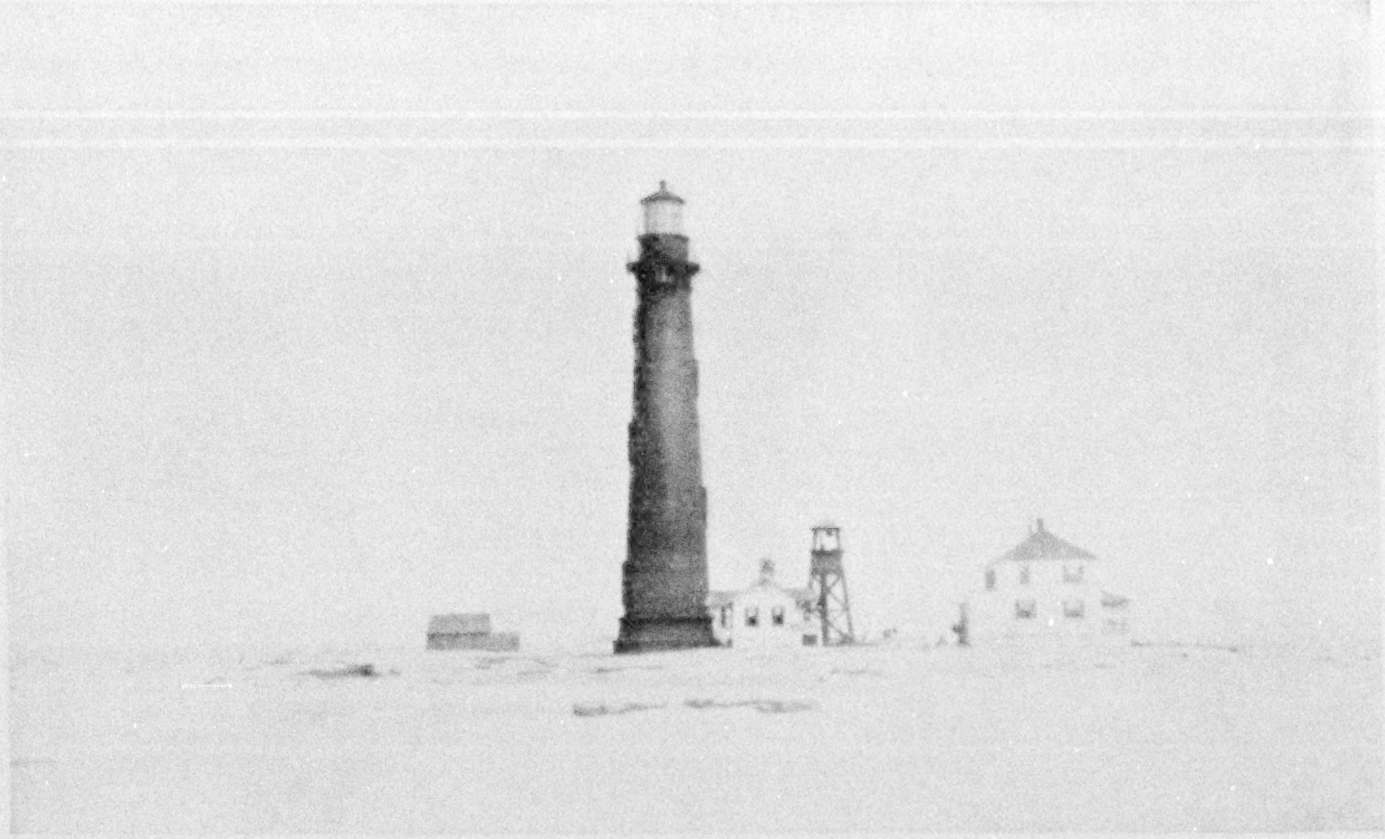
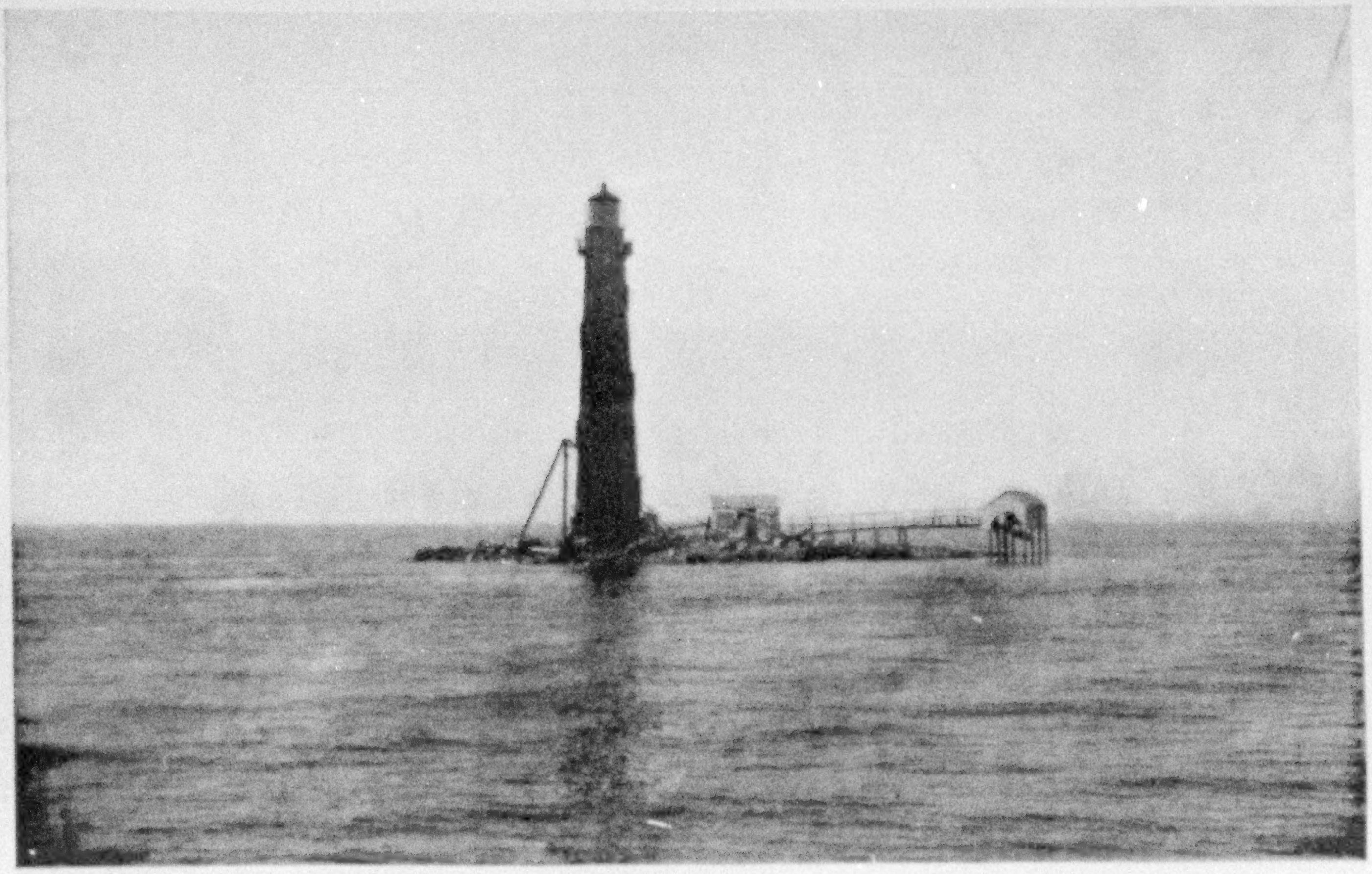
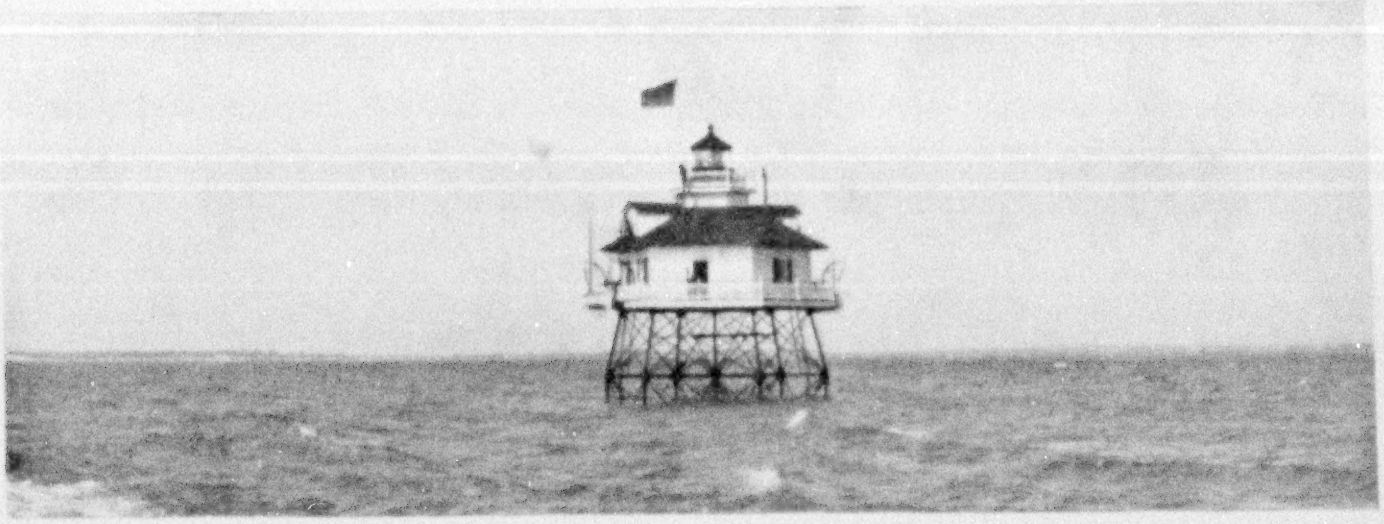


THE SAND ISLAND LIGHT STATION, ALABAMA, BEFORE THE HURRICANE OF SEPTEMBER, 1906

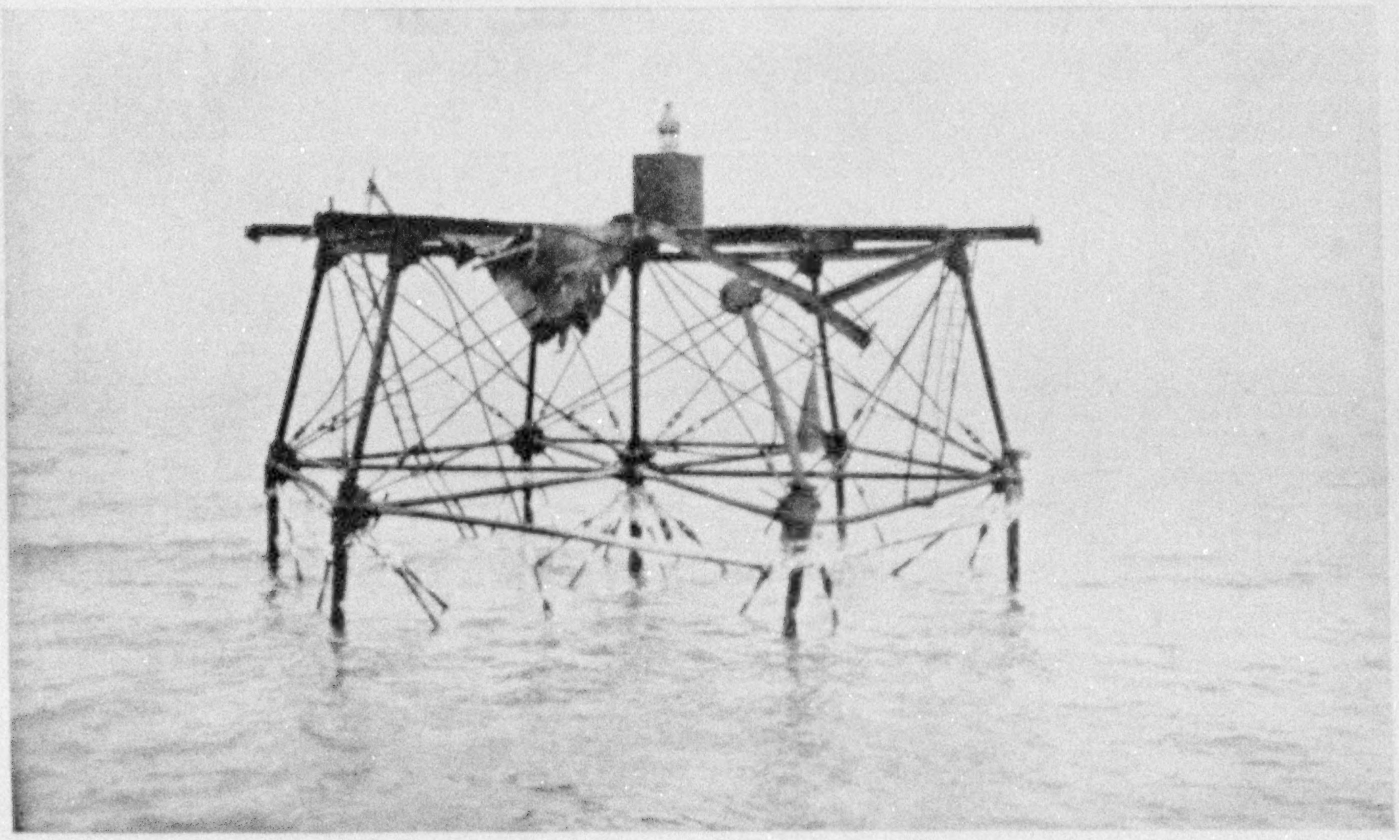


THE SAND ISLAND LIGHT STATION AFTER THE HURRICANE

This storm washed away the island with the keeper's dwelling, and the keeper and his wife were lost (see page 29)



THE ORIGINAL THIMBLE SHOAL LIGHT STATION, VIRGINIA



THE THIMBLE LIGHT STATION AFTER A SCHOONER HAD COLLIDED WITH IT AND SET IT ON FIRE

A temporary light is shown, pending the building of a more substantial structure, now under way

while the consumption of oil has been reduced from 2,280 gallons to 1,300 gallons a year.

Electric lights are used at a few light stations only. The expense is too great to warrant the employment of electricity at many important stations. For some harbor lights it can be used to advantage by taking current from a local source of supply, and a light can thus be maintained in an exposed position and controlled from the shore.

The electric light at Navesink, on the highlands just south of New York harbor, is the most powerful coast light in the United States. This light shows each five seconds a flash of one-tenth second duration estimated at 60 million candle power. Although, on account of the curvature of the earth, the light itself cannot be seen more than 22 miles, its beam has been reported to have been observed in the sky at a distance of 70 nautical miles (see page 39).

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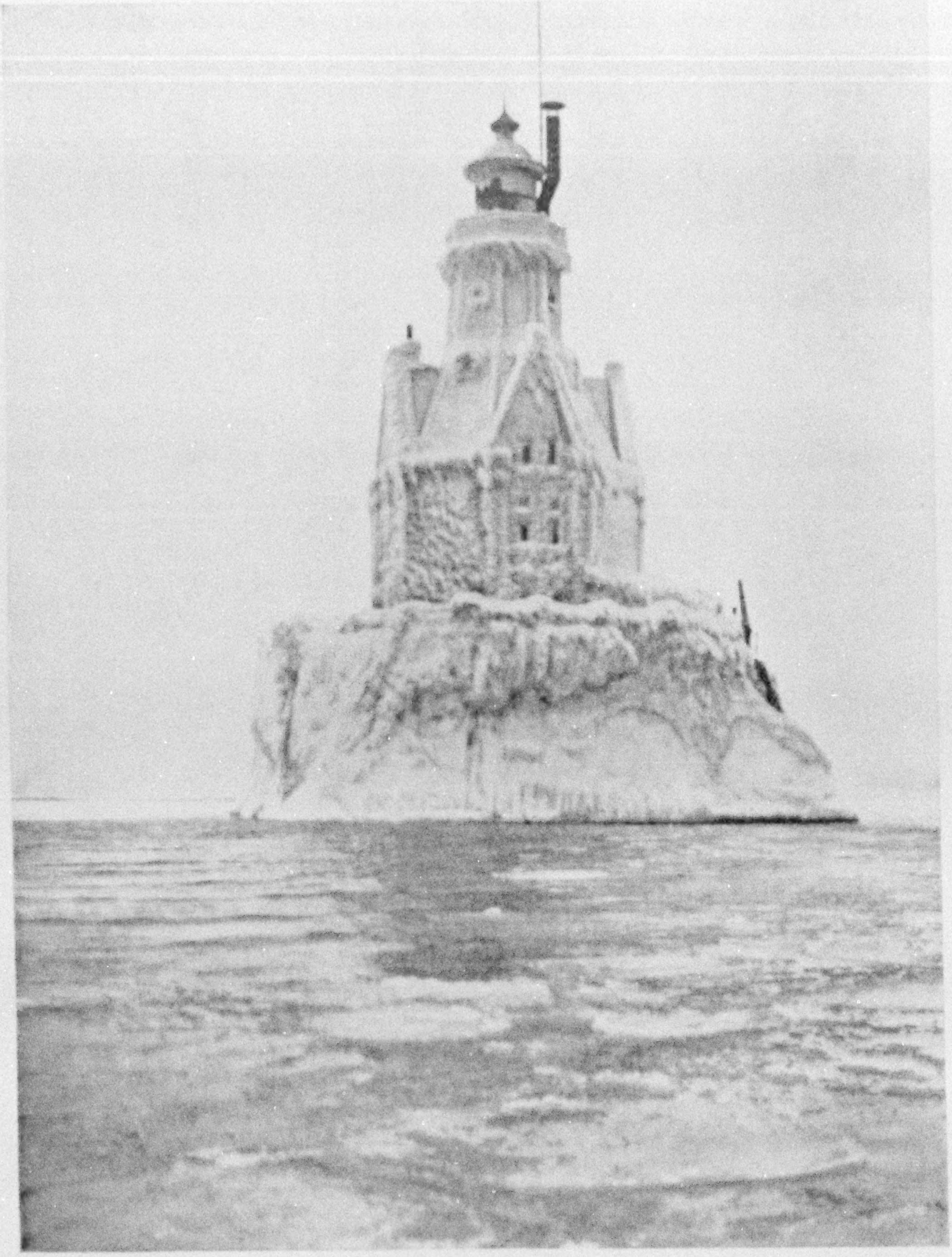
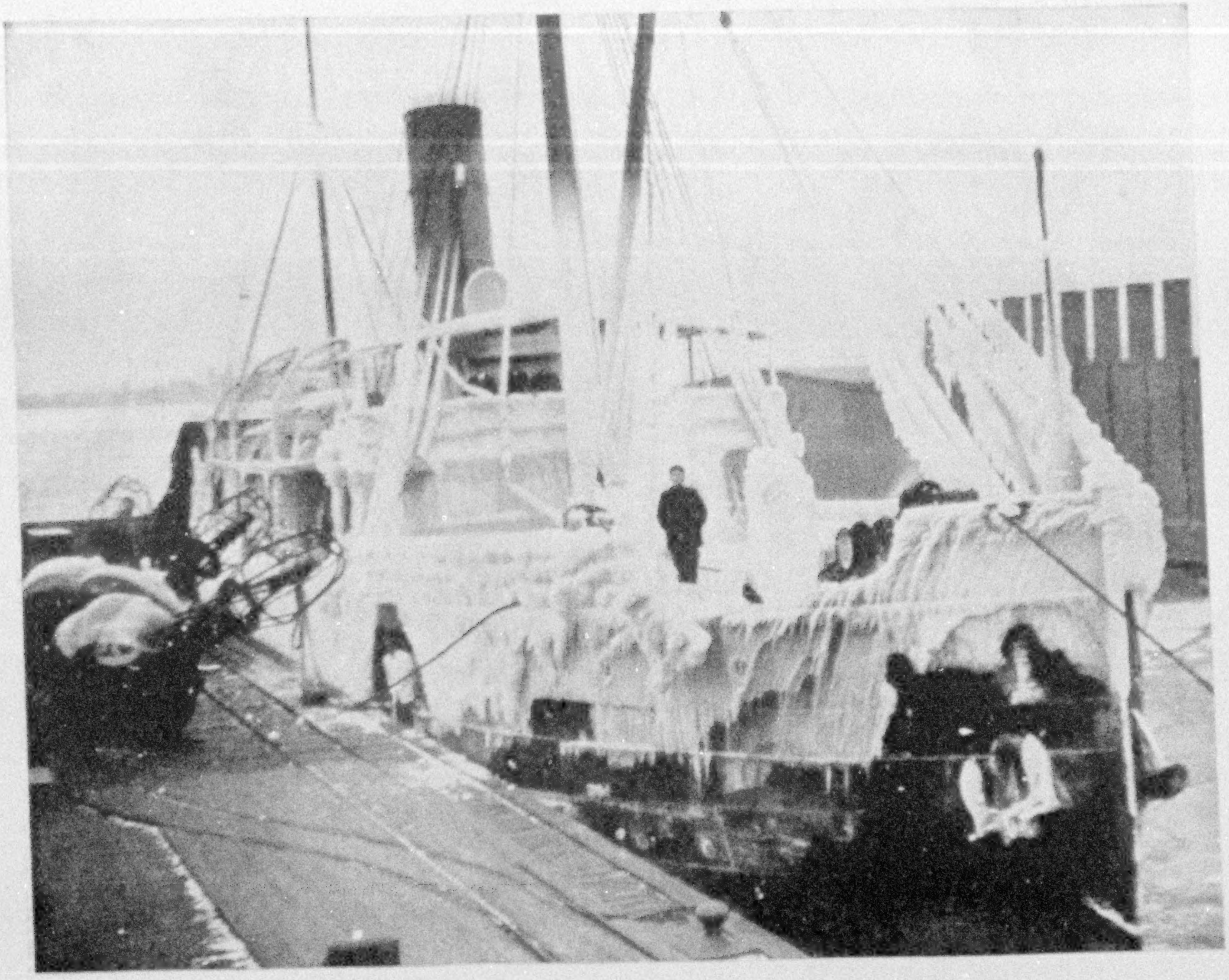


THE RACINE REEF LIGHTHOUSE, IN LAKE MICHIGAN, COVERED WITH ICE

"Winter seriously increases the work of maintaining aids to navigation; the spray or sleet freezing may completely envelop the tower in ice, obscuring the light until the lantern is cleared. In northern waters, where there is floating ice, many of the gas buoys must be removed in winter and replaced by spar buoys, over which the ice may pass without serious damage to the buoy. The spray freezes to bell buoys sometimes until the weight of ice overturns them" (see page 29).



LIGHTHOUSE TENDER CROCUS JUST IN FROM WINTRY WORK ON LAKE ERIE NEAR THE END OF THE SEASON OF NAVIGATION

Most of the lighthouses on the Great Lakes are closed during the winter months, when general navigation ceases on those waters. There is risk to men and vessels in taking off the keepers in the winter gales at the close of navigation" (see page 29).

LIGHTS THAT BURN FOR MONTHS WITHOUT A KEEPER

There has in recent years been a greatly increased use of gas as an illuminant for minor lights, such as unattended lighted beacons and lighted buoys; this is due to the facility with which gas may be stored or generated, the light burning for considerable intervals without attention. There are also a few coal or oil gas harbor lights, supplied from local sources.

There are in use a large number of acetylene gas-lighted beacons, supplied by tanks of gas of sufficient capacity to maintain a quick flashing light for five months without attention. In other acetylene lights the gas is generated from carbide at the station or in the buoy. Oil gas under compression is also extensively used for lighted buoys, having been first employed for this purpose in 1878. Some of the acetylene beacons are provided with a sun valve, which saves gas by automatically cutting off the gas supply during the time the sun shines.

A gas beacon has recently been established on Richardsons Rock, a wave-swept rock west of the Santa Barbara Islands, California. It would have been very expensive to build a lighthouse with keepers' quarters on this rock, so this flashing beacon was established to give present protection to vessels from the danger. This beacon, without attendance, will flash its warnings every 3 seconds for 7 months (or over 6 million flashes) before it requires another charge of gas (see page 36).

Ten years ago the first light in Alaska was established; now there are 95 in that territory, and the rapid increase of recent years has been due largely to the facility

XUM

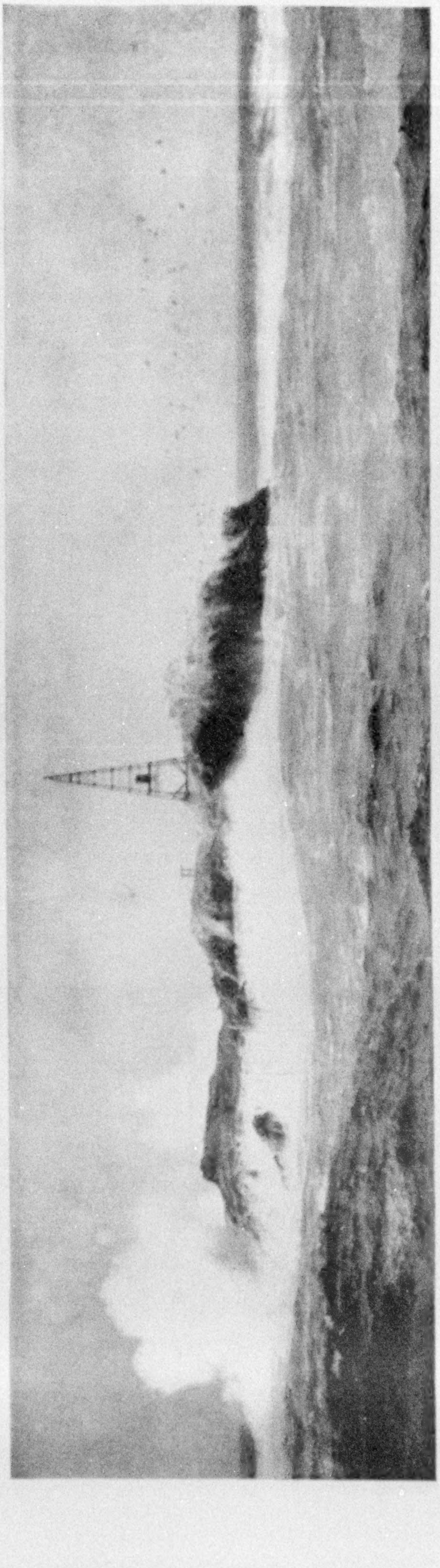
with which flashing gas lights, unattended, may be established in that region, where it would be difficult and expensive to maintain keepers. At stations, however, where there are fog signals, keepers must be stationed, as there is not yet available a practical automatic fog signal for land use.

POWERFUL REFLECTORS, LENSES, AND PRISMS ARE USED

In order to increase the effectiveness of illumination, reflectors, lenses, and prisms are used to concentrate the light and throw it out either in a plane around the horizon or in a beam or limited arc, where it will be most useful. Parabolic reflectors were introduced about 1763, and to show around the horizon or to render the light more powerful it was necessary to mount on a chandelier a number of lamps each with its own reflector. Thus in an early list of American lights the number of lamps is given, as Boston lighthouse 14 lamps, and Sandy Hook 18 lamps.

The French physicist, Augustine Fresnel, beginning in 1822, revolutionized lighthouse practice by inventing a system of annular lenses, refractors, and reflecting prisms, all of glass and surrounding a single central lamp. Various forms of lenses designed on these principles, with further improvements, are now universally used in lighthouse work, varying from the simple lens lantern, with a single annular lens, to the great first-order lenses, built of many pieces of beautifully cut and polished glass.

Of such a lens the distinguished lighthouse engineer, Alan Stevenson, wrote: "Nothing can be more beautiful than an entire apparatus for a fixed light of the first order. It consists of a central belt of refractors, forming a hollow cylinder 6 feet in diameter and 30 inches high; below it are six triangular rings of glass, ranged in a cylindrical form, and above a

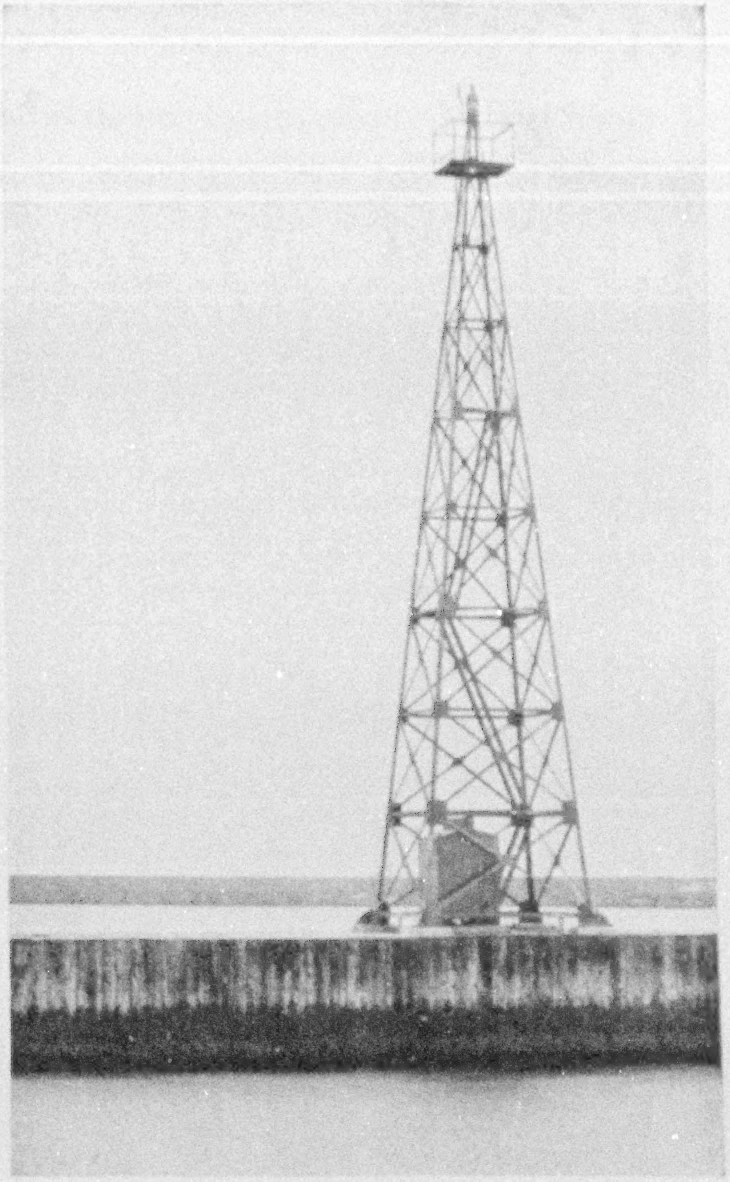


AN UNATTENDED FLASHING GAS LIGHT ON RICHARDSONS ROCK, CALIFORNIA

This light will flash every 3 seconds for seven months before it requires another charge of gas. This would be a difficult and expensive site on which to establish a regular lighthouse with keeper's quarters (see page 35) crown of thirteen rings of glass, forming by their union a hollow cage, composed of polished glass, 10 feet high and 6 feet in diameter. I know of no work of art more beautifully creditable to the boldness, ardor, intelligence, and zeal of the artist."

With the most complete lenses about 60 per cent of the light is rendered useful, the balance being lost at the top and bottom and by absorption of the glass of the lens and the lantern.

The first lens in the United States was installed at Navesink light in 1841. The largest lens in this service is that at Makapuu Point light, Hawaii, which is 8¾ feet in diameter. The introduction of more powerful illuminants and quick-flashing lights, with lenses concentrating more of the light, has rendered large diameter lenses unnecessary (see page 41).



AN ACETYLENE GAS LIGHT, THE FAIRPORT WEST PIER LIGHT, OHIO

Gas tanks at base; light automatically occulting every two seconds. Sun valve to the left of lantern automatically cuts off the light while the sun shines.

INGENIOUS METHODS TO DISTINGUISH LIGHTS FROM EACH OTHER

It is important that lights be so distinguished from each other as to avoid the possibility of the mariner mistaking one for another. To this end lights are distinguished by their number, color, intensity, or time of visibility. Before the introduction of flashing or occulting lights, in a few cases two or three light-towers were built close together to give a distinctive combination, an example being the two lighthouses on Thatcher Island, Cape Ann. This is an expensive method not now employed for new lighthouse work.

Color distinctions, especially red, have been widely used, but are not suitable except for minor lights because of the great loss of power; with the best color, red, the loss is about 60 per cent. For lights to be seen at close range, two lights are sometimes shown, one vertically above the other.

With the systems now available of flashing and occulting lights, it is possible to obtain a great variety of clearly distinguishable characteristics. The first revolving light was installed in Sweden in 1763. The earlier slow revolving lights are now generally superseded by lights giving a flash or various combinations of flashes at shorter intervals, or lights showing continuously except for short occultations. Quick-flashing lights were first introduced in France about 1892.

The most powerful flashing lights are arranged to have the entire lens revolve, the beam from each panel of the lens appearing as a flash as it sweeps past the observer. To obtain rapid and smooth revolution, the lense is mounted on a mercury float, and a lens weighing, with fittings, as much as 7 tons may make a complete revolution in 30 seconds.

A recent example is the lens for Kilauea light station, Hawaiian Islands, built in France and costing about $12,000, including import duty. The moving part weighs nearly 4 tons and turns on a mercury float, making a complete revolution

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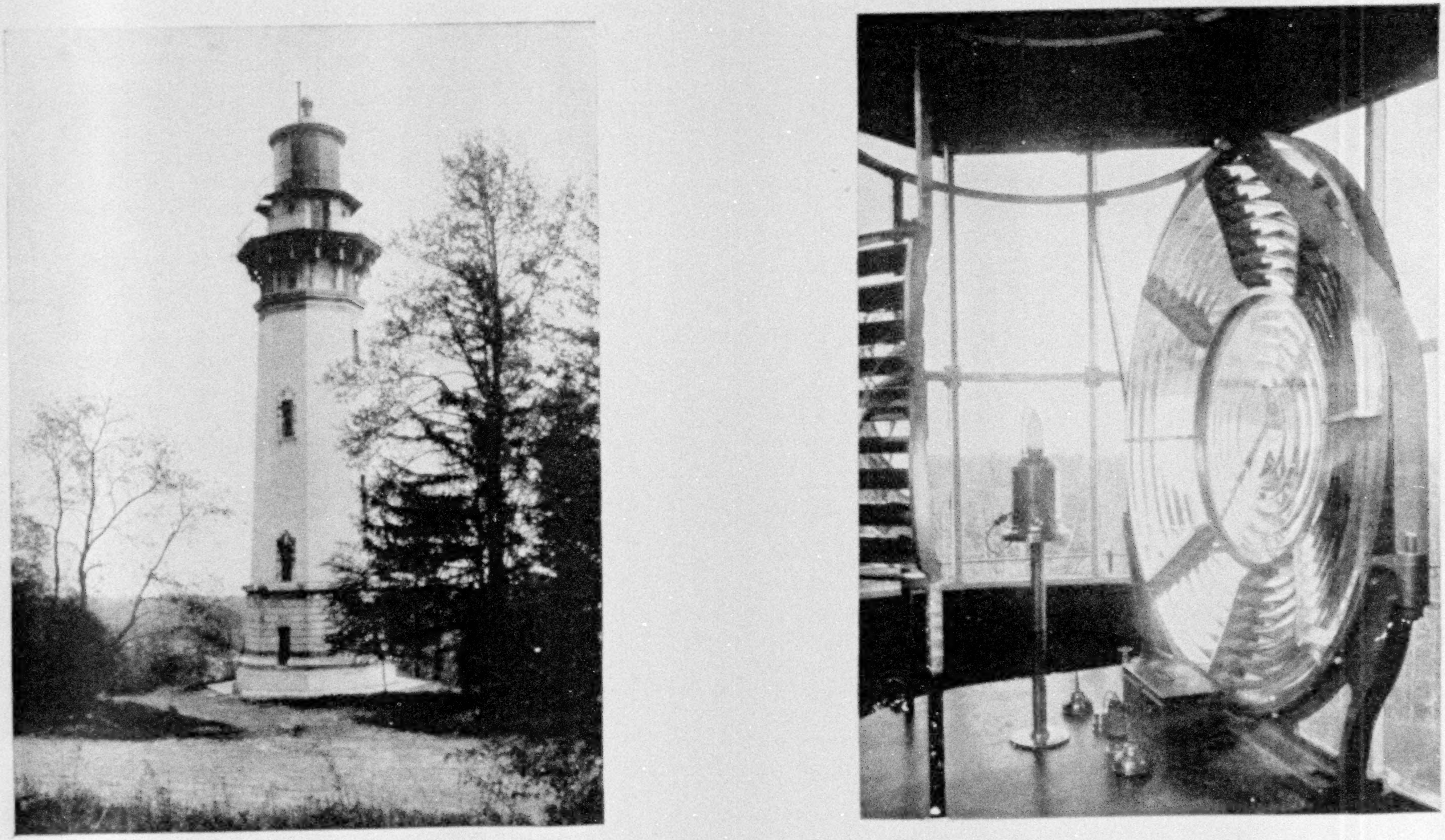


VIEWS OF THE STATEN ISLAND LIGHT: THE REAR RANGE LIGHT FOR AMBROSE CHANNEL, NEW YORK

The view of the interior of the lantern shows the fixed lens and reflector with incandescent oil vapor lamp (see page 31). "For the more important lights the incandescent oil vapor lamp is now used, having been introduced by the French in 1898. In this lamp the oil is heated and then vaporized, and is burned mixed with air under a mantle which is made incandescent. This gives a much more brilliant light than the wick lamp, with a smaller consumption of oil. For instance, this change of lamps recently made at Cape Hatteras light has increased the brilliancy of the light from 34.000 to 160,000 candle power, while the consumption of oil has been reduced from 2,280 gallons to 1,300 gallons a year" (see pages 32 and 33).

THE MOST POWERFUL LIGHT OF THIS COUNTRY, ESTIMATED 60,000,000 CANDLE POWER: THE NAVESINK LIGHTHOUSE, NEW JERSEY

"The electric light at Navesink, on the highlands just south of New York harbor, is the most powerful coast light in the United States. This light shows each 5 seconds a flash of one-tenth second duration estimated at 60 million candle power. Although, on account of the curvature of the earth, the light itself cannot be seen more than 22 miles, its beam has been reported to have been observed in the sky at a distance of 70 nautical miles (see page 33).

every 20 seconds and giving a double flash of about 940,000 candle power every 10 seconds. The light is sufficiently powerful to be visible 40 miles, but because of the earth's curvature it can be seen only 22 miles (see page 42).

Occulting lights are less efficient, the occultations being obtained by revolving a screen around the light, by a drop shutter, or by blank panels in a revolving lens. With gas lights, flashes or occultations may be obtained by automatically interrupting the gas supply, a small pilot light still remaining.

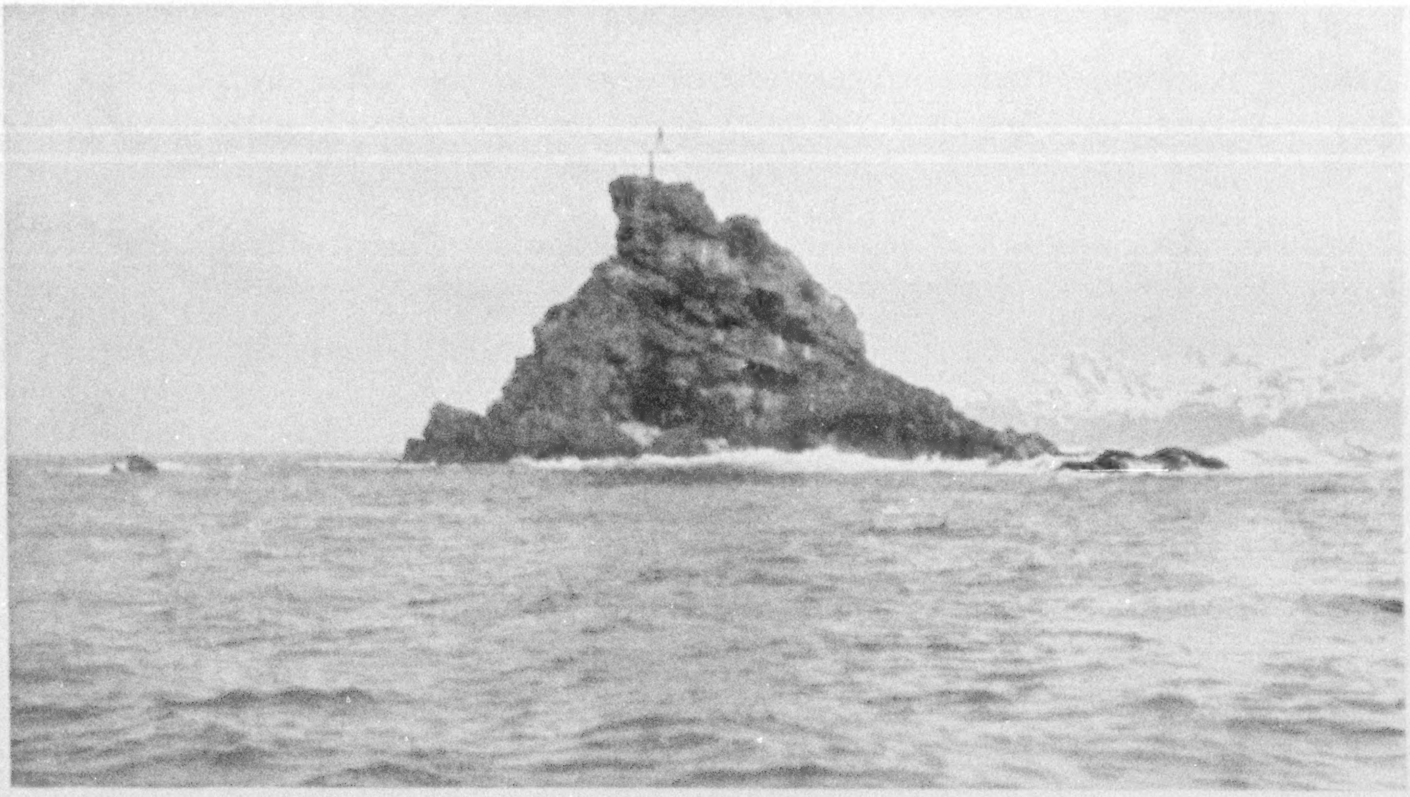
The earlier lighthouses all showed fixed lights, and were equipped with lamps giving only moderate candle power. There is always danger of mistaking the identity of a fixed light, as it may be confused with other lights on shore or on vessels, or one lighthouse mistaken for another, and marine disasters have resulted from such mistakes.

All countries have, therefore, long since undertaken to change the fixed lights at important coast points and give them a distinctive characteristic, and also to increase the brilliancy of illumination.

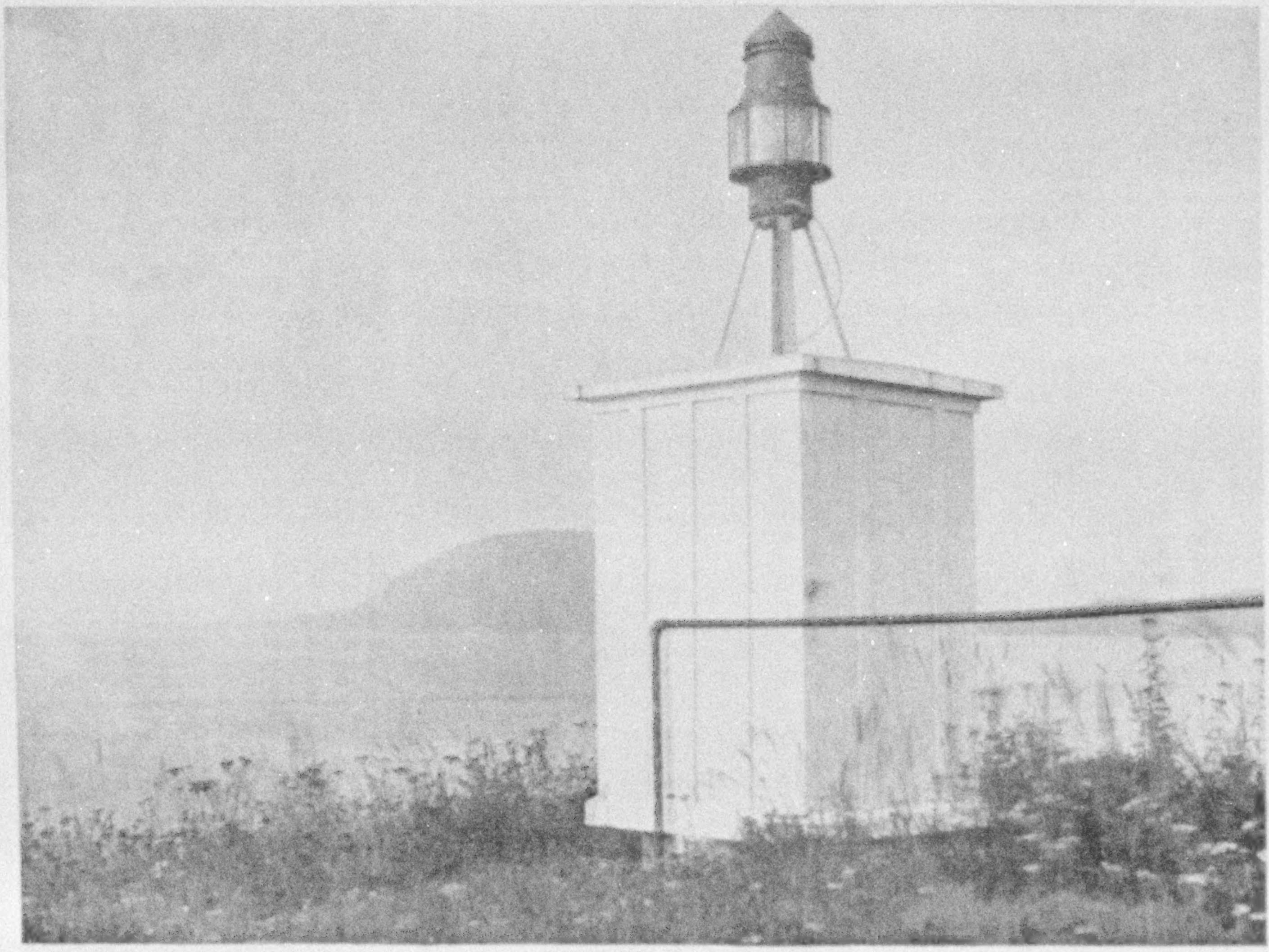
To indicate the steady progress made along these lines, during the past two years this service has changed 47 lights from fixed to flashing or occulting, and at 68 light stations has substituted incandescent oil-vapor lamps for oil-wick lamps, the latter greatly increasing the brilliancy, with a diminished consumption of oil.

DAYMARKS

In addition to the lights, many other marks are provided to assist navigators. The light-towers themselves are painted and shaped to make good landmarks in the daytime, and special beacons and spindles are placed usually to mark shoals or other dangers. Nature and man also provide many landmarks valu-



AN UNATTENDED FLASHING LIGHT AT THE ENTRANCE TO PRINCE WILLIAM SOUND: THE ZAIKOF POINT LIGHT STATION, ALASKA (SEE PAGE 35)



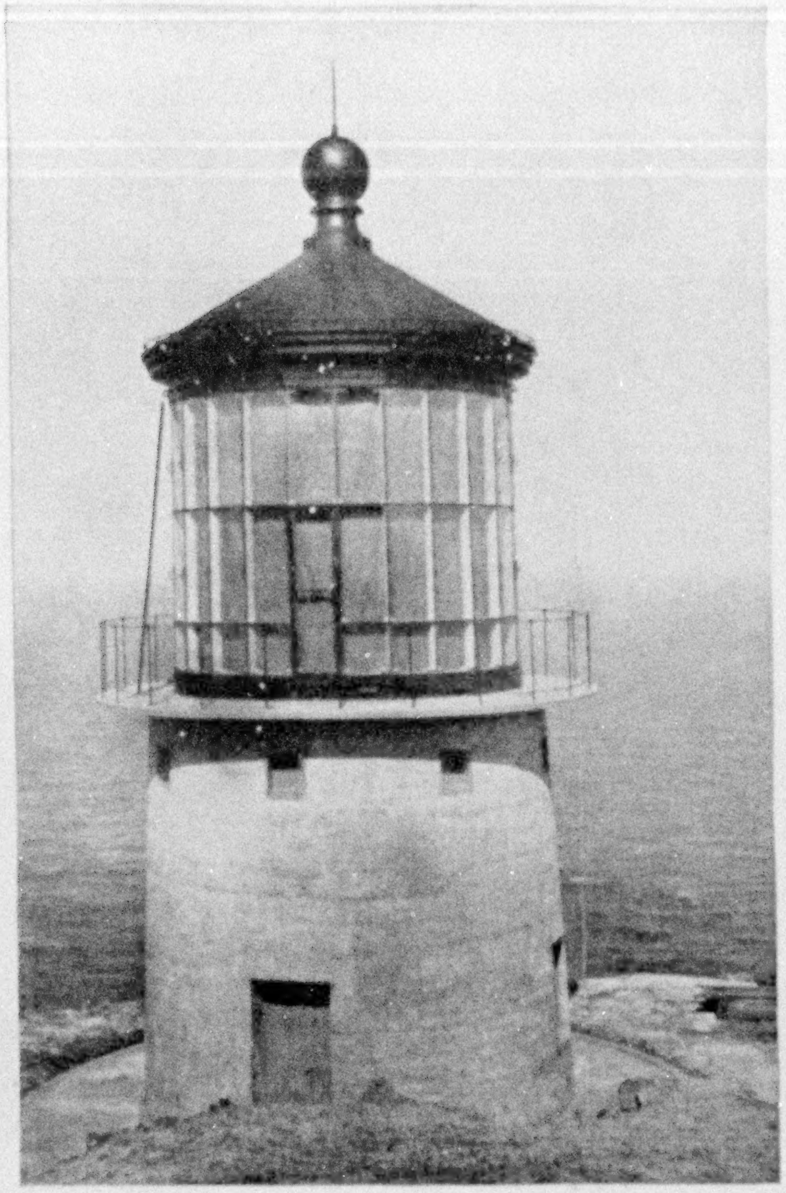
A LIGHT WHICH FLASHES EVERY 3 SECONDS FOR 5 MONTHS WITHOUT ATTENDANTS

Many such lights have been installed to mark the inside passages in Alaska. This one is placed at Point Retreat, Alaska able to mariners, but which are not included in the official aids.

LIGHT VESSELS

All thus far mentioned are known as fixed aids to navigation, but it is frequently desirable to put marks in the water where the depth or other conditions do not permit of the building of a lighthouse or beacon. More than half the aids to navigation maintained by the Lighthouse Service are floating—light vessels or buoys moored in position.

Light-ships are placed in locations off the coast, where it would be impracticable or needlessly expensive to build a lighthouse, and they usually mark the approach to a port or bay or the outer limit of an offlying danger. They are also sometimes used in inside waters. They may be moored in the channel or close to it, and they have the advantage over most lighthouses, that a vessel may steer directly for them without danger so long as collision with the light vessel is avoided, and also that they may be moved and moored in another position when change of conditions or necessity requires. On the other hand, a light vessel is more expensive to maintain, and there is the possibility of its being driven from its station, though this is reduced in recent years by improved vessels and moorings.



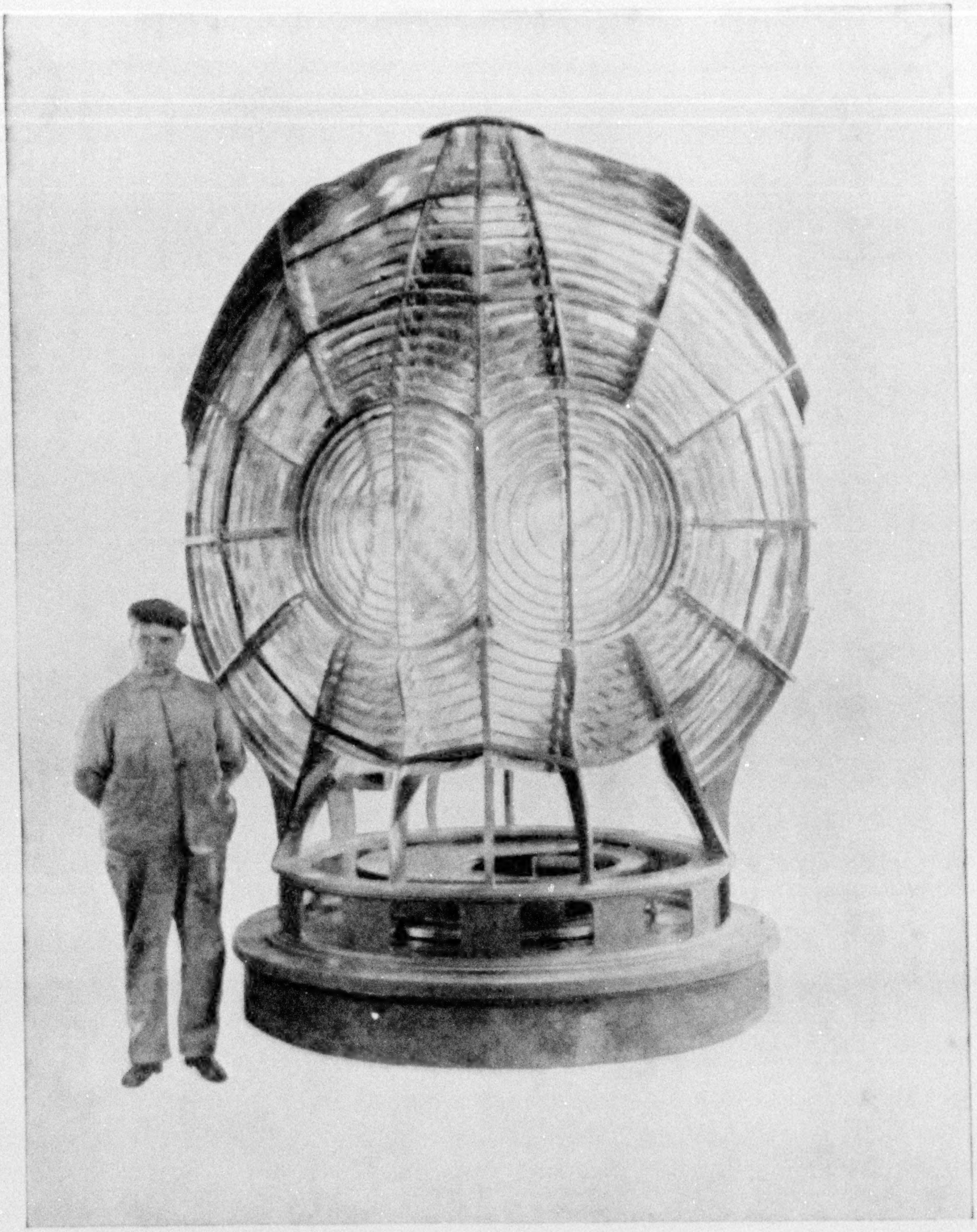
THE LARGEST LENS OF THE U. S. LIGHTHOUSE SERVICE

The lens is 8¾ feet in diameter, an occulting light eclipsed for 1½ seconds each 9 seconds. Makapuu Point Light, Hawaiian Islands.

The first light-ship, the *Nore*, was established in England in 1732, at the mouth of the Thames. The first in this country was stationed in 1820 in Chesapeake Bay, off Willoughby Spit. Sandy Hook, now Ambrose, light vessel was established in 1823. A light vessel was placed off Cape Hatteras in 1824 and was driven ashore in 1827, and a ship was not established again in this dangerous position until 1897, after unsuccessful attempts had been made to build a lighthouse on Diamond Shoal.

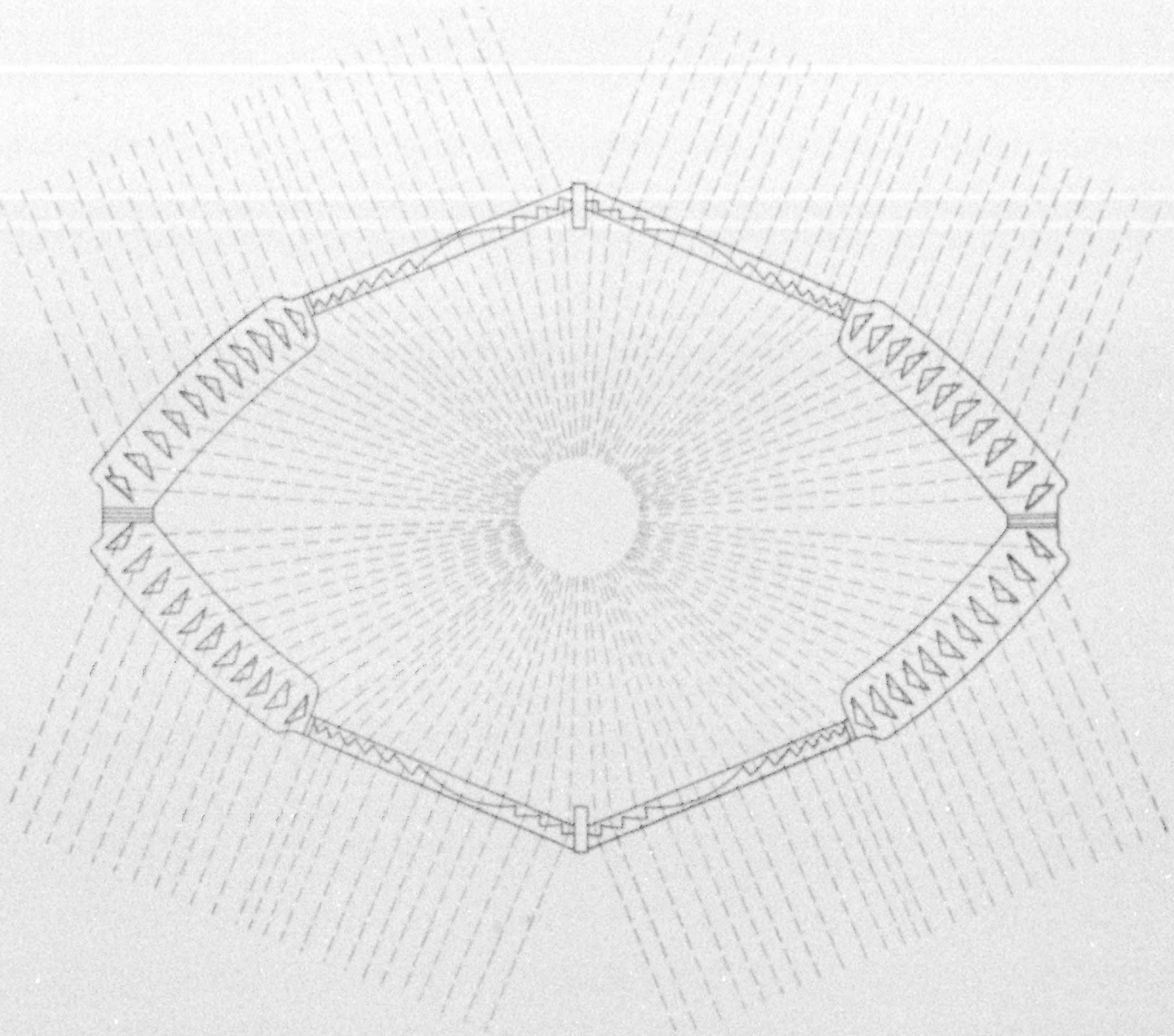
The United States maintains light vessels on 51 stations, and there are a number of relief ships, so that the regular ships may be brought in for repairs. Some of these positions are of the greatest importance to mariners, as, for example, the Nantucket Shoals light vessel, moored 41 miles from land, for which most of the transatlantic vessels steer in approaching America, and the Diamond Shoals light vessel, moored in 30 fathoms of water 13 miles off Cape Hatteras and marking the most dangerous locality on the Atlantic coast of the United States. These larger ships are full-powered vessels, capable of returning to their station, and they each have a crew of 15.

The latest ships are provided with powerful and distinctive lights and fog signals. They more nearly approach the lighthouse in design, having a heavy tubular iron mast surmounted by a lan-



A BEAUTIFUL GLASS LENS AND MOUNTING RECENTLY BUILT IN FRANCE FOR THE KILAUEA LIGHTHOUSE NOW UNDER CONSTRUCTION IN THE HAWAIIAN ISLANDS

It will be the landfall light approaching the islands from Japan. The light will give a double flash of 940,000 candle power every 10 seconds. The lens and mounting "weighs nearly 4 tons and turns on a mercury float, making a complete revolution every 20 seconds and giving a double flash of about 940,000 candle power every 10 seconds. The light is sufficiently powerful to be visible 40 miles, but because of the earth's curvature it can be seen only 22 miles" (see pages 37 and 39).



A CROSS-SECTION THROUGH THE LAMP OF THE LENS SHOWN ON PRECEDING PAGE, SHOWING HOW THE LENS DIRECTS ALL THE LIGHT OUT IN FOUR BEAMS, IN TWO GROUPS

tern, sometimes with a revolving lens supported like a pendulum to hang vertically, so that the light beam will be kept near the horizon regardless of the motion of the vessel. An example is the recently completed Milwaukee light vessel, which will show a double flash every 10 seconds. This vessel has a fog signal giving two blasts each minute, with intervals of 7 and 46 seconds.

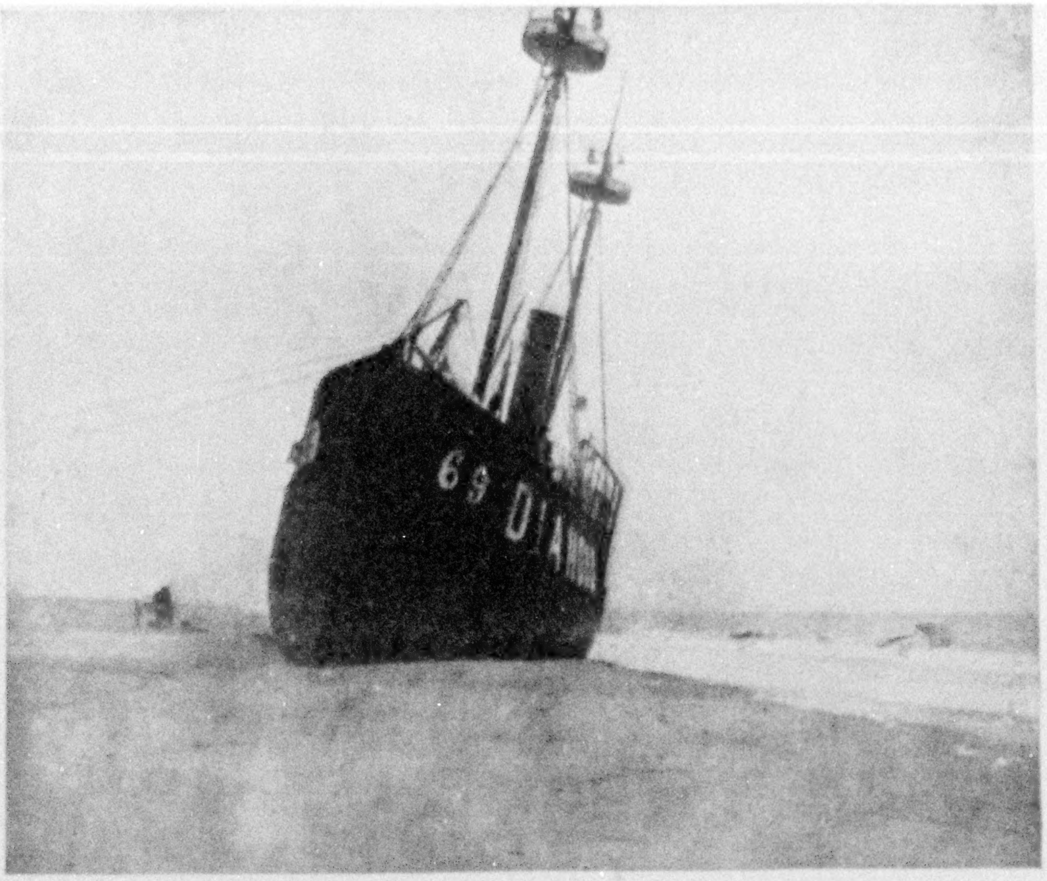
LIFE ON THE LIGHT-SHIPS

Life on a light-ship is somewhat dreary, but not without excitement. During every fog the crew on Nantucket ship know that numerous vessels are headed directly for them, and in a storm, anchored as they are in the open sea, they may be far from comfortable. The men in turn are allowed liberal leave ashore. There are often serious difficulties in getting coal and provisions to the ships on exposed stations, so that it is necessary that they carry sufficient supplies to last over stormy periods.

In 1899 the Columbia River light vessel was stranded near Cape Disappointment, and as it could not be gotten off into the sea again, it was hauled 700 yards across the land through the woods and launched in the Columbia River.

The light-ships, being necessarily near the channel ways, are frequently collided with. In January, 1912, a schooner ran into Diamond Shoal light vessel. The master, in his report, describes the damage done and states that "the 6 seamen and also the cook worked manfully all night in trying to save the mainmast," and that "repairs having been made, the light having been kept burning as usual, and the ship kept in right position, unless very severe weather sets in the vessel will stay here until relieved."

The directions of the Superintendent of Lights in 1829 to the master of a light vessel instruct him "not to slip or cut the cable, or suffer it to be done, in any event, and if the vessel should be likely to founder, to abandon her with his crew."



DIAMOND SHOAL LIGHT VESSEL, NORTH CAROLINA

This vessel is anchored in 30 fathoms of water in the Atlantic Ocean 13 miles off Cape Hatteras, and occupies one of the most exposed and dangerous positions. The vessel is shown after being stranded in 1899. The diagram below shows the improved method now in use of mooring light vessels with a submerged buoy.

Notwithstanding the severe conditions, Diamond Shoal light vessel has in recent years been maintained on the station with little interruption. The vessel is now moored with a 7,500-pound mushroom anchor and 150 fathoms (900 feet) of heavy chain. About one-third of the length from the vessel a submerged spherical buoy is attached to the chain, carrying a part of its weight and greatly easing the pull of the vessel.

In recent years some unattended light vessels have been established abroad. These are small vessels without any crew and with all the apparatus automatic in operation. The Barrow light vessel, on the coast of England, with no crew, has an automatic flashing gas light with a revolving lens, a fog bell in the air, and a submarine bell, both actuated by the motion of the vessel in the sea (see page 48).

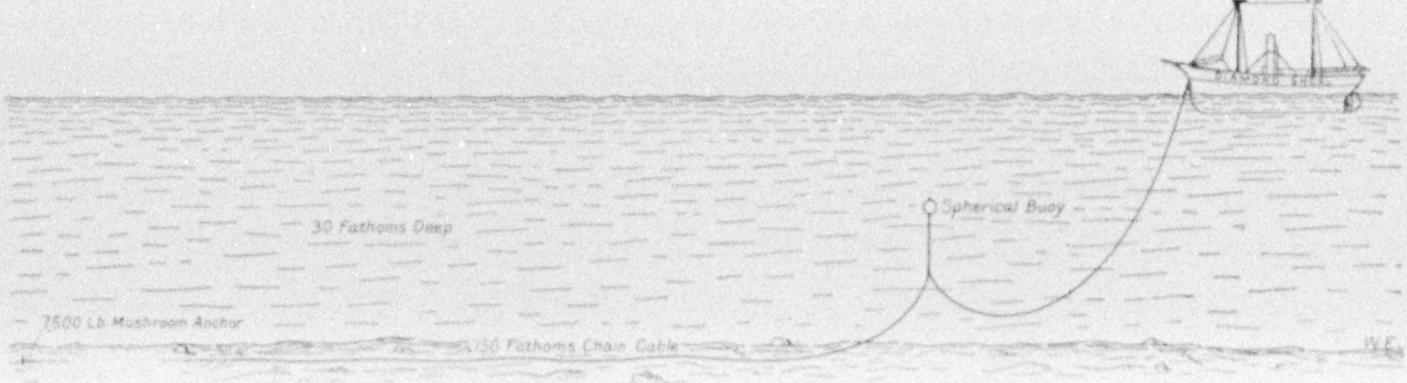
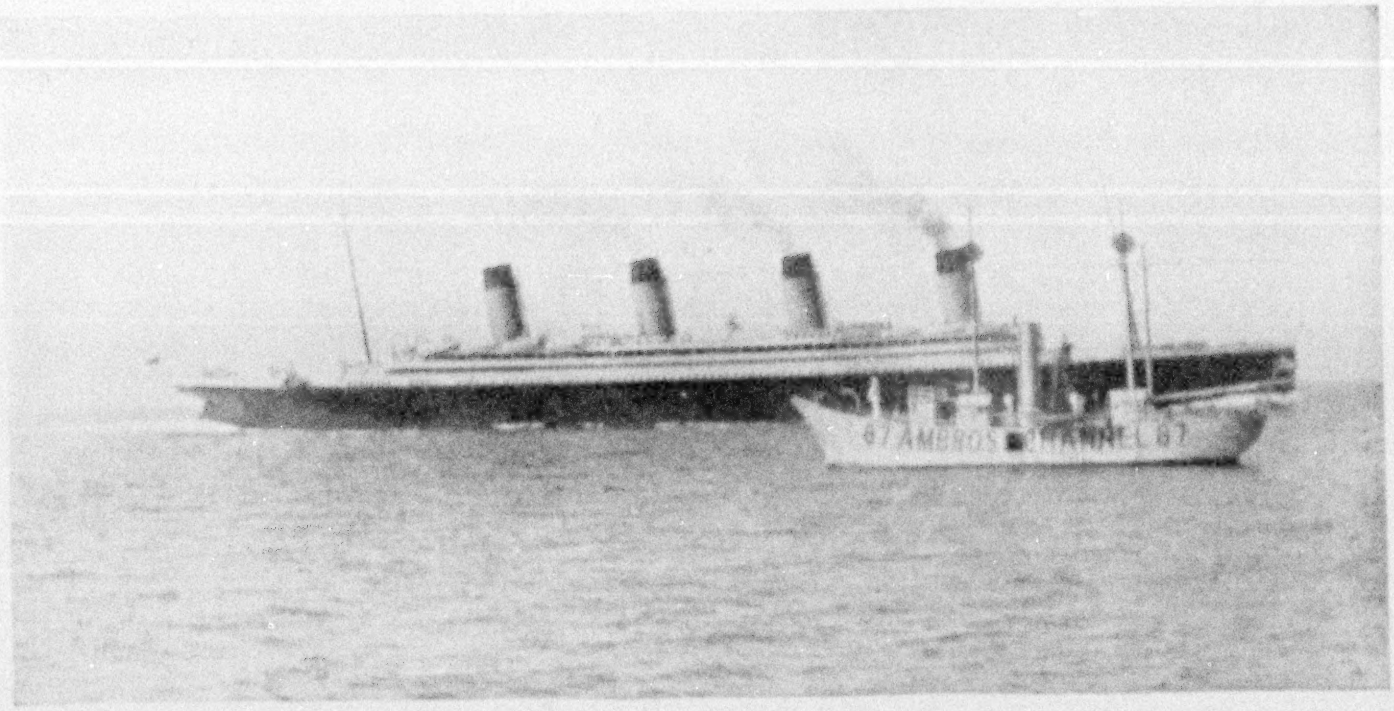


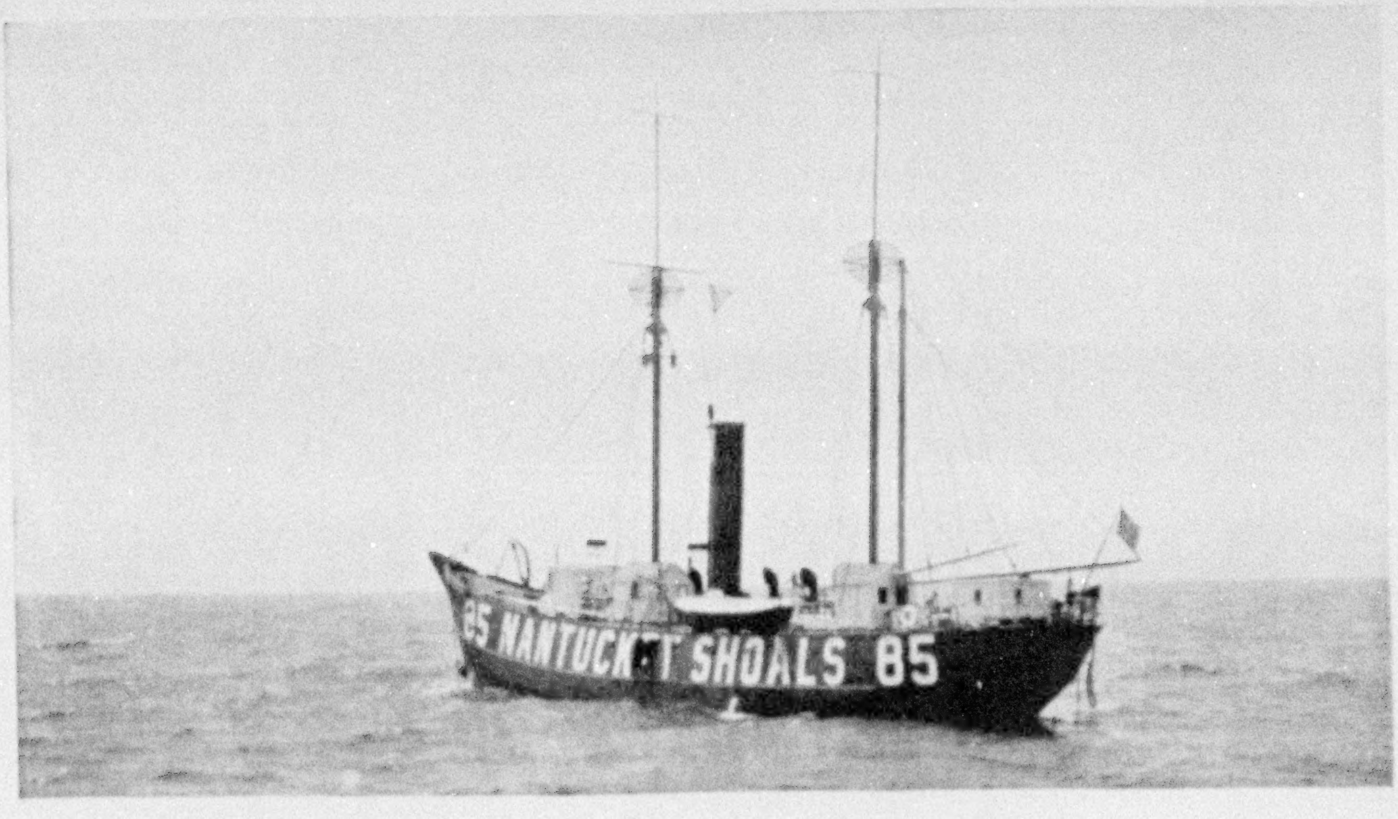
DIAGRAM SHOWING THE MOORING ARRANGEMENT OF DIAMOND SHOAL LIGHT VESSEL

Length of chain on buoy, 7½ fathoms; from the anchor to buoy chain, 105 fathoms; from buoy chain to ship, 45 fathoms



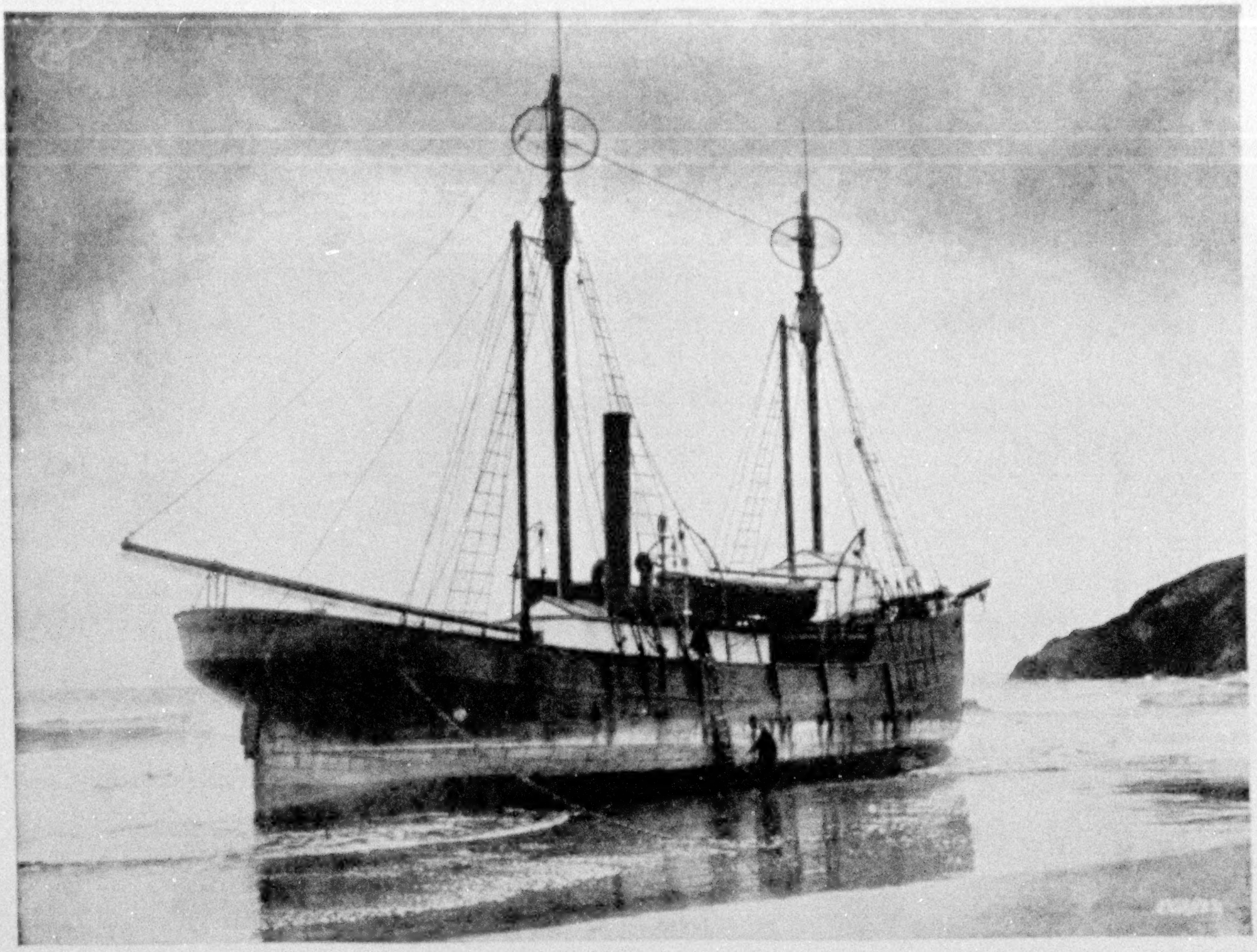
THE AMBROSE LIGHT VESSEL AND AN OCEAN LINER

This light vessel is anchored off the entrance to New York Bay. Ocean passages are reckoned to or from this ship. "Light-ships are placed in locations off the coast where it would be impracticable or needlessly expensive to build a lighthouse, and they usually mark the approach to a port or bay, or the outer limit of an offlying danger. They are also sometimes used in inside waters. They may be moored in the channel or close to it, and they have the advantage over most lighthouses, that a vessel may steer directly for them without danger so long as collision with the light vessel is avoided, and also that they may be moved and moored in another position when change of conditions or necessity requires. On the other hand, a light vessel is more expensive to maintain, and there is the possibility of its being driven from its station, though this is reduced in recent years by improved vessels and moorings" (see page 41).



THE NANTUCKET LIGHT VESSEL, MOORED IN THE ATLANTIC 41 MILES FROM LAND

Most of the transatlantic vessels steer for this vessel. "Life on a light-ship is somewhat dreary, but not without excitement. During every fog the crew on Nantucket ship know that numerous vessels are headed directly for them, and in a storm, anchored as they are in the open sea, they may be far from comfortable. The men in turn are allowed liberal leave ashore. There are often serious difficulties in getting coal and provisions to the ships on exposed stations, so that it is necessary that they carry sufficient supplies to last over stormy periods" (see page 43).



THE COLUMBIA RIVER LIGHT VESSEL, AFTER BEING STRANDED ON CAPE DISAPPOINTMENT IN 1899, WAS HAULED THROUGH THE WOODS 700 YARDS AND LAUNCHED INTO THE RIVER (SEE PAGE 43)

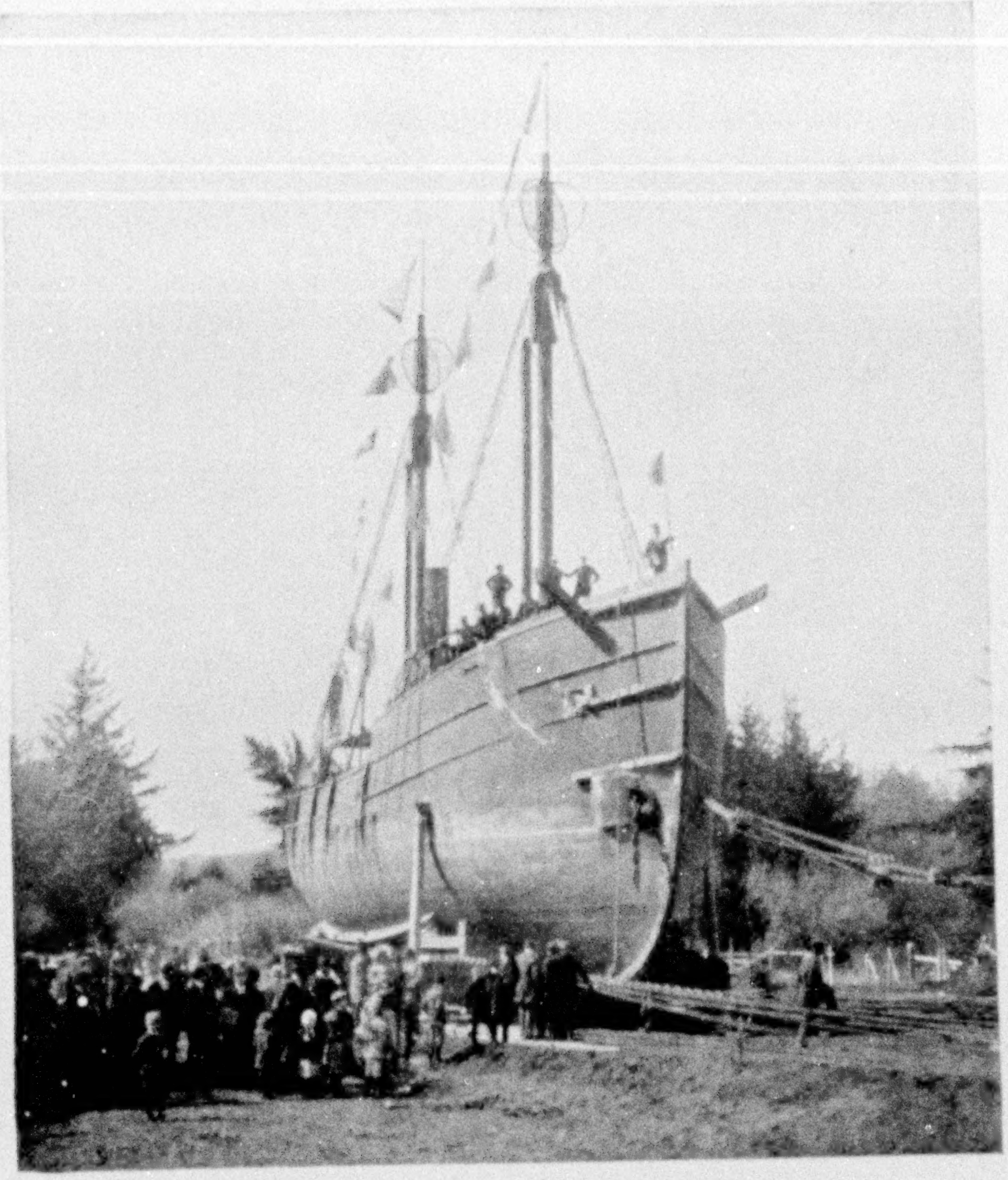
BUOYS

Floating buoys are efficient and relatively inexpensive aids to navigation. They are used to mark dangers—as shoals, rocks, or wrecks—to indicate the limits of navigable channels, or to show the approach to a channel. They vary in character according to their purpose or the distance at which they should be seen. The simpler forms are the wooden and iron spar buoys, and iron can and nun buoys. For warning in thick weather, buoys are fitted with bells, whistles, and submarine bells, all actuated by the motion of the sea.

Some important buoys are lighted, usually by means of oil gas compressed in the buoy itself or acetylene gas compressed in tanks placed in the buoy or generated in it. The light is often flashing or occulting, for the purpose both of providing a distinctive mark and of prolonging the supply of gas. The use of gas buoys has greatly increased in recent years, there being at present 346 in this country. They are a very valuable addition to the aids for the benefit of mariners, and often obviate the necessity of establishing much more expensive light vessels or range lights on shore.

The buoy off the entrance to Ambrose Channel, New York harbor, at a height of 27 feet above the water, shows a light of 810 candle power, occulting every 10 seconds and visible 10 miles. This buoy recently burned for one year and four months without recharging. The buoy is nearly 60 feet long and weighs over 17 tons (see page 50).

Buoys are painted and numbered to indicate their position and the side on which they should be passed. To keep the 6,700 buoys of this country on their proper stations and in good order is a heavy work and is one of the principal



THE COLUMBIA LIGHT VESSEL JOURNEYING THROUGH THE WOODS

uses for the lighthouse tenders. Buoys may be damaged or sunk, or dragged or broken from their moorings by vessels or tows, or wreckage, or ice.

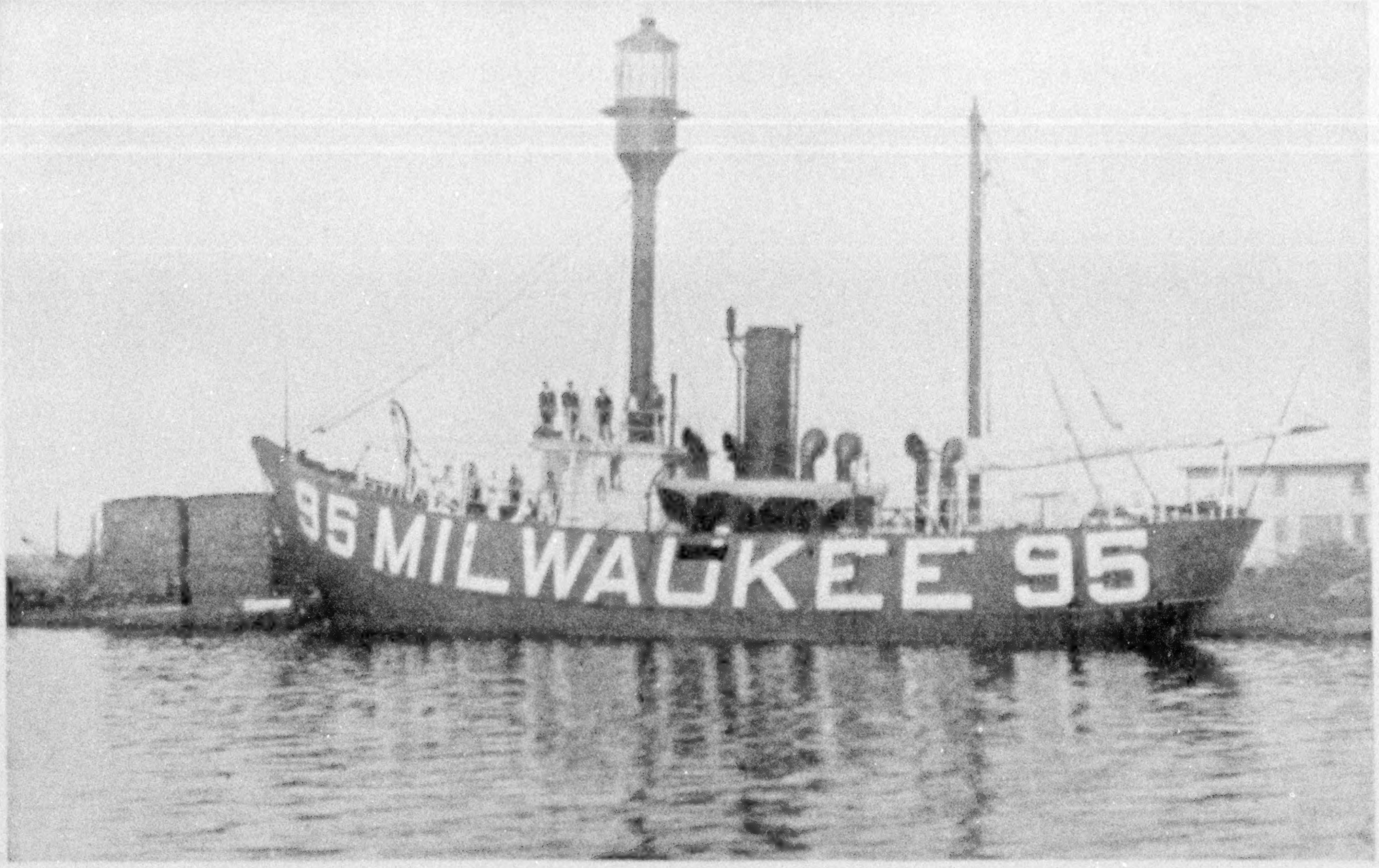
Two buoys from the Atlantic coast of this country have been picked up on the coast of Ireland, and one from the California coast was found in the Hawaiian Islands, these having gotten adrift and been carried across the oceans by the currents.

For use in mooring buoys and light vessels, the Lighthouse Service purchases annually about 15,000 fathoms of chain, a length equal to 17 statute miles.

FOG SIGNALS

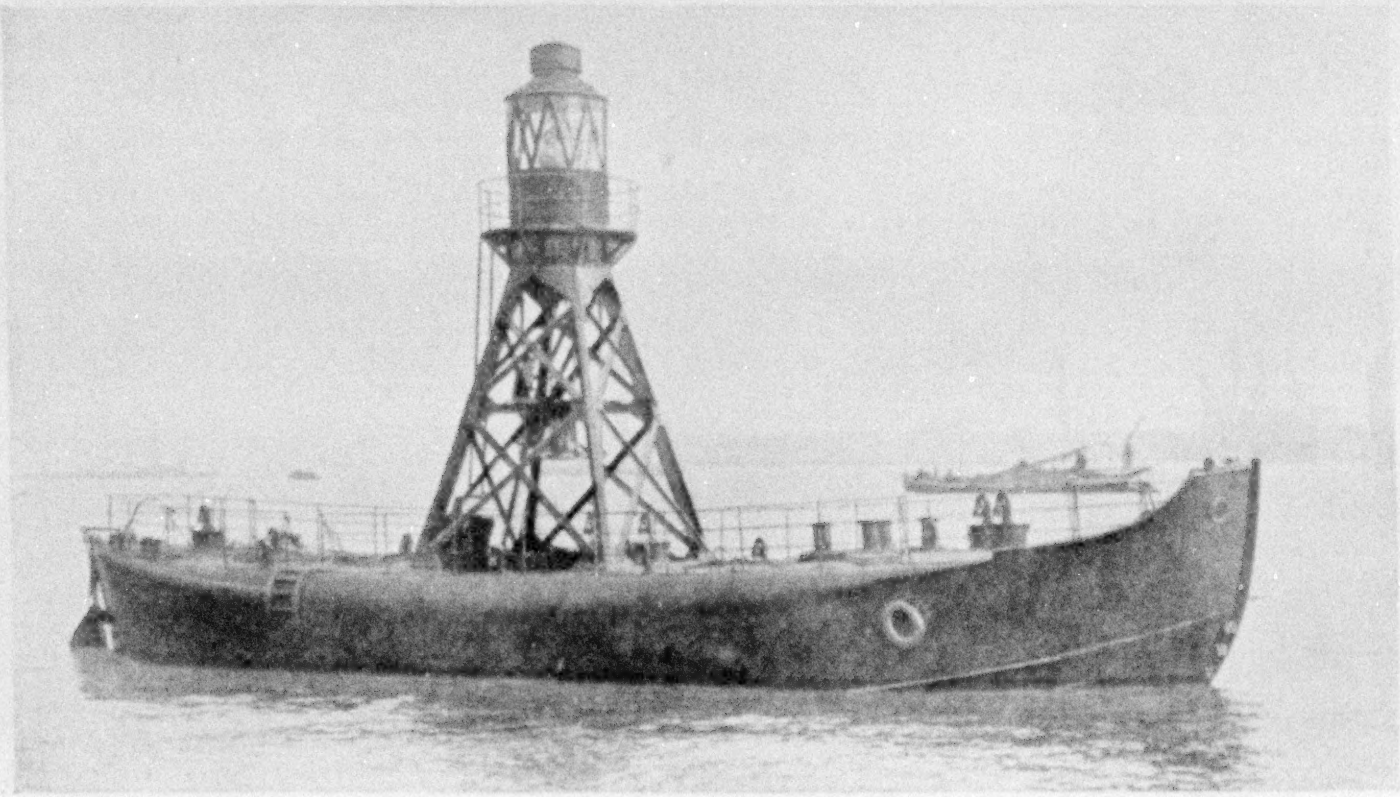
The most powerful coast lights may be rendered of little or no use to navigation by thick fog or rain. To assist vessels under such conditions, making their course more safe or allowing them to proceed, fog signals of many sorts have been established. Of these the bell is the most common, and until about 1850 the only signals in use were bells and guns. The first fog signal on the Pacific coast of the United States was established at Bonita Point, San Francisco Bay, in 1856—a fog gun to be fired each half hour.

The fog signals now in use in the United States consist of sirens, whistles, reed trumpets, aerial bells, and submarine bells. Sirens and whistles are operated by compressed air or steam, and trumpets by compressed air. To furnish air, compressors driven by internal combustion engines are used, and for steam signals boilers are employed. The larger fog bells, up to 4,000 pounds, have hammers actuated by a weight and clock-



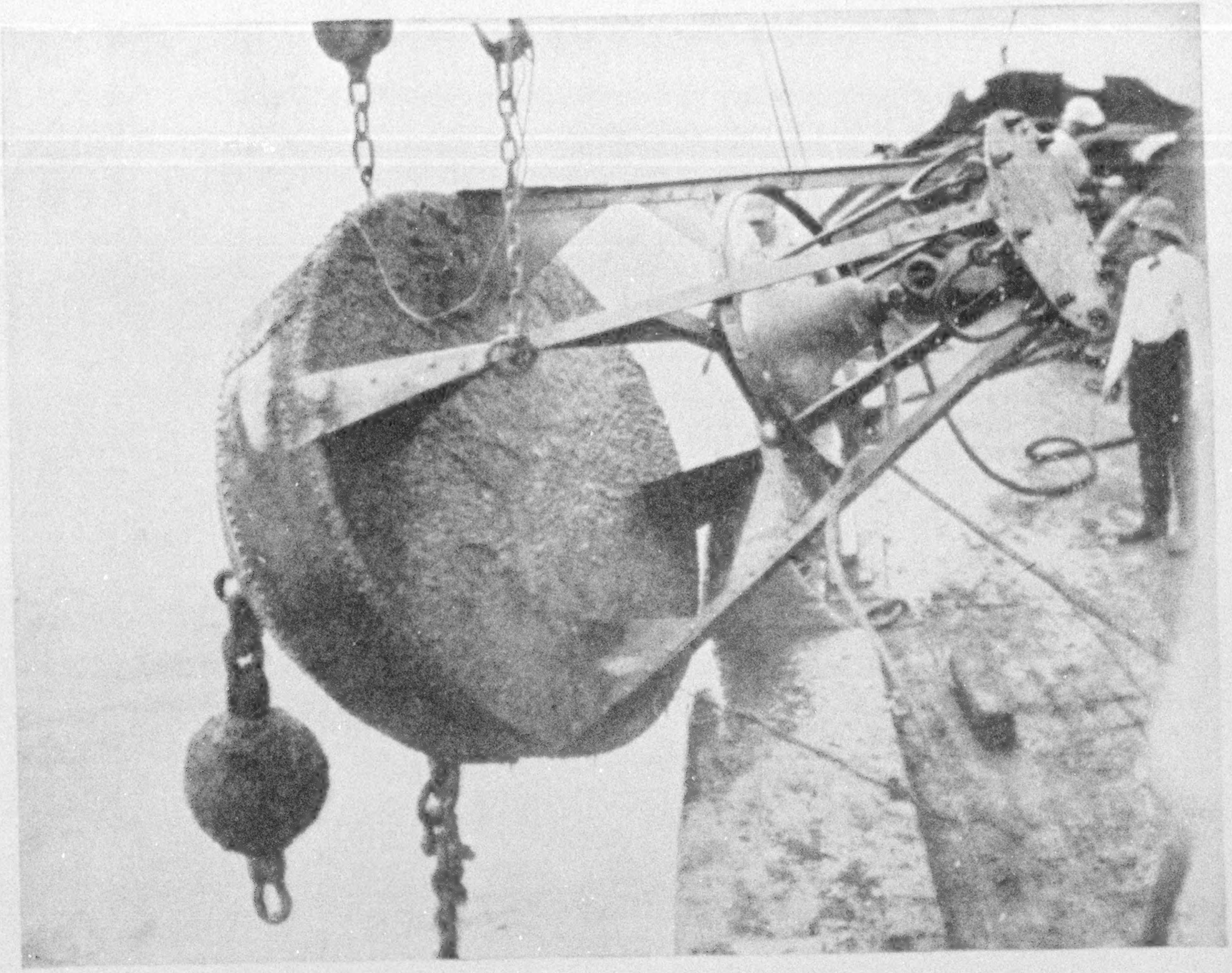
THE MILWAUKEE LIGHT VESSEL, THE LATEST BUILT IN THIS COUNTRY

It has a hollow steel mast, through which access is had to the lantern surmounting it. The lantern will be fitted with a revolving lens giving a flashing light (see page 43)



AN UNATTENDED LIGHT VESSEL ON THE COAST OF ENGLAND

It has no crew, and is equipped with flashing gas light, aerial fog bell, and submarine fog bell, all automatic. The bells are operated by the motion of the vessel in the sea



A BELL BUOY TAKEN ON BOARD LIGHTHOUSE TENDER

Shows marine growth and the necessity for periodic cleaning and painting of buoys

work. The smaller bells are rung by hand. Besides the above, there are various noise-making buoys; bells, whistles, and submarine bells are attached to buoys and are made to sound by the movement of the buoy due to the sea.

There are also used abroad several other types of fog signals. The diaphone, similar to the siren, explosive signals, consisting of a tonite or other explosive fired from the top of a mast, and recently there has been installed, experimentally, at several light stations in France apparatus for sending signals by wireless telegraphy, and a compass has been invented which from a vessel will give the direction of the sending station.

Nearly all fog signals excepting those on buoys are operated to sound a characteristic signal so that they may be distinguished, there being a succession of blasts or groups of blasts or strokes at regular time intervals, which are made known for each station. Even adjacent buoys are differentiated by the use of whistles and bells and by variation of tone.

A first-class fog-signal station requires powerful and expensive machinery and skilled attendance. Such a station may have duplicate engines of 20 horsepower each, and the signal may consume 100 cubic feet of free air per minute.

While aerial fog signals furnish a very valuable aid to navigation under weather conditions when assistance is most needed, yet they are far from the ideal of perfection. Sounds are transmitted through the air erratically, and sometimes within a comparatively short distance of a station the fog signal may be inaudible, while in other directions it may be heard for long distances. This is due to the effect of the adjacent land or to conditions in the atmosphere, the sound being reflected or the sound waves

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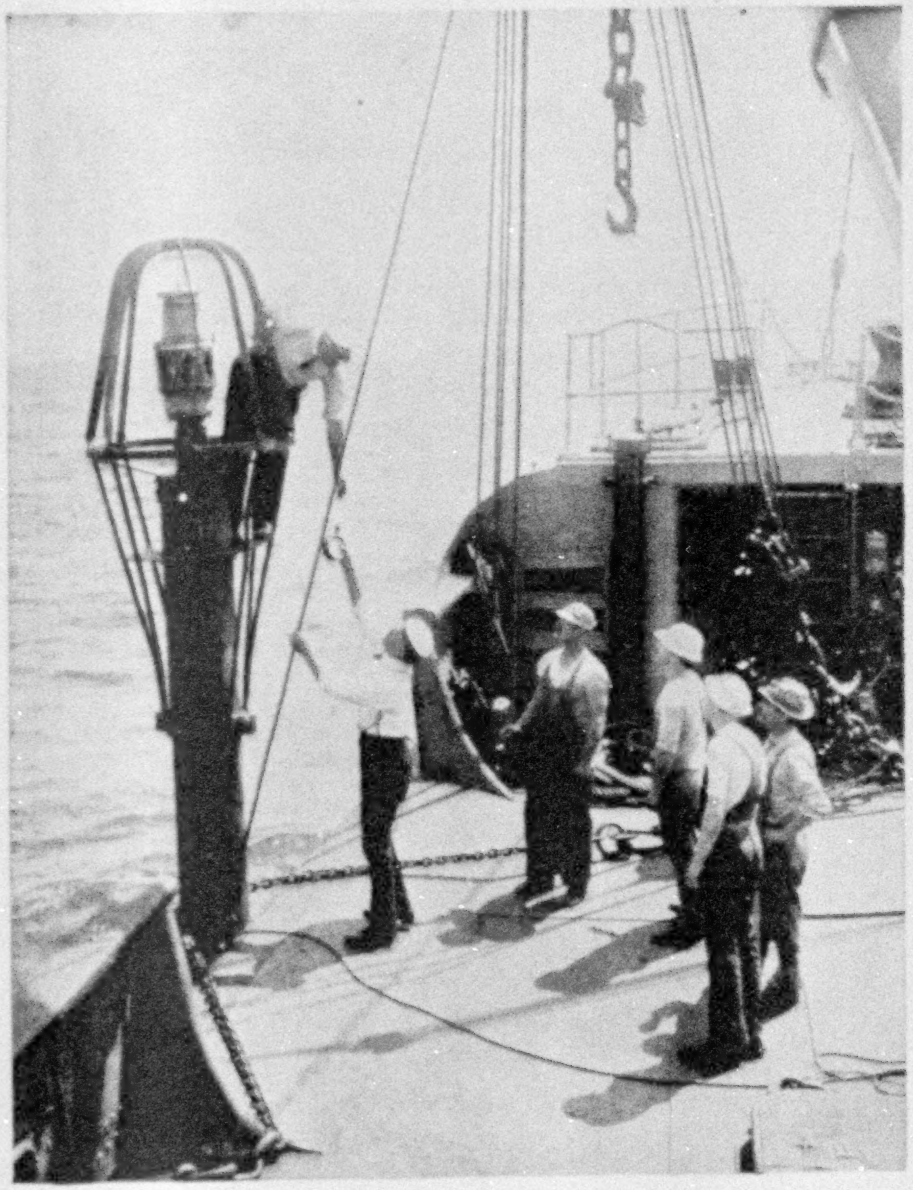

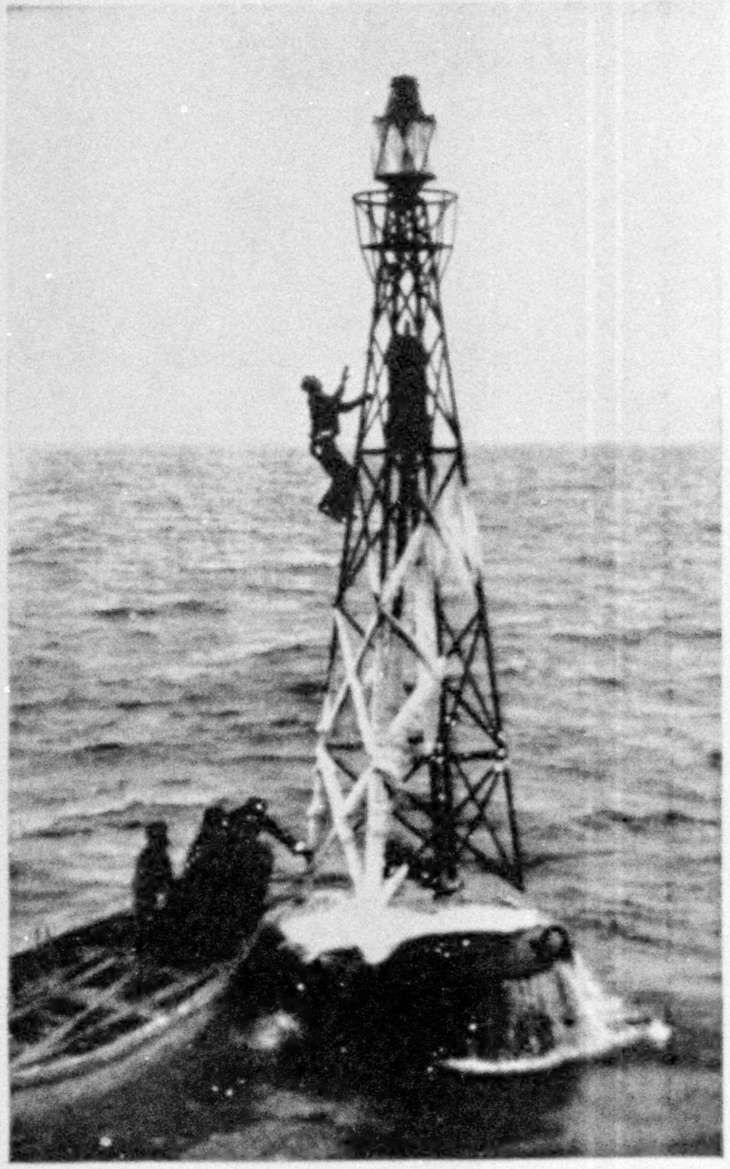

GAS BUOY ALONGSIDE A TENDER, BEING RECHARGED WITH OIL GAS

The great gas buoy off New York entrance with light 27 feet above the water, which recently burned for 16 months without attention, occulting every 10 seconds deflected or retarded; the subject is one of importance, requiring further investigation.

There is sometimes an unfortunate conflict of interest between the need of a loud and distinctive sound to aid the mariner in a fog and the quiet and comfort of seashore residents in whose midst the fog-signal station may be located. Even the mournful note of the whistling buoy may bring complaints from the near-by shore residents.

Keepers at fog-signal stations must maintain a continuous watch day and night, as the signal must be started promptly on the approach of fog. Some portions of the coast have little or no fog, as on the south Atlantic and Gulf coasts, where there are but few fog signals; there are no fog signals in Porto Rico or in the Hawaiian Islands. Fogs and thick weather are very prevalent on the New England and the Pacific coasts. At the station at Seguin Island, Maine, there were, in 1907, 2,734 hours of fog, more than 30 per cent of the entire year.

SUBMARINE BELLS

Submarine bells were first regularly employed as fog signals in the United States in 1906. The bell is suspended in the water from a light vessel to a depth of 25 to 30 feet and is operated by compressed air, or the bell is mounted on a tripod on the bottom and worked by electric power transmitted from the shore through a cable, or it is suspended from a buoy and actuated by the motion of the sea, which moves a vane and winds a spring (see page 52).

Sound from submarine bells is transmitted through the water more uniformly and effectively than it is through the air from an aerial signal, but the efficient use of submarine bells requires that vessels be equipped with suitable receiving apparatus attached to the hull on each bow and telephonically connected with the wheel-house; by comparing the loudness on the two sides the direction of the signal may be obtained. Submarine bells have frequently been heard through the water at distances of 15 miles and more.

LIGHTHOUSES MAINTAINED BY ALL COUNTRIES

As of the surface of the earth 51,886,000 square miles is land, as compared with 145,054,000 square miles of water, it is evident that a large part of the commerce of the world will always be carried on this great water area. Lights and buoys and fog signals are essential to safeguard the ships as they approach the continents and follow the coasts, and these or other suitable guides will be needed for aerial traffic, should it ever develop.

The proper lighting and marking of the coasts is an obligation assumed by all modern maritime nations. The lights protect not only the ships of the country maintaining them, but the vessels of other nations as well. The lighthouse, for instance, at Cape Maysi, on the east end of Cuba, is of great value to many ships which never call at a Cuban port. A lighthouse on Cape Spartel, Africa, at the entrance to the Mediterranean, is maintained jointly by the contributions of 11 nations, including the United States.

But there is a great difference today in the manner in which the shores of different seas are lighted. The official British lists give a total of about 11,600 lighthouses and light-ships for the entire world, but of these 8,900 are on the coasts of Europe, the United States, and Canada, while Asia, Africa, Australia, the remainder of America, and the islands of the sea have together about 2,700. South America has but 300 lights, and Africa 500.

A region of interest to our shipping, much of which is badly lighted and marked, is the area including the Caribbean Sea, the West Indies, and Central America. For example, the large island of Haiti has not a lighthouse at any one of its three prominent extremities. The only lights on Haiti are four harbor lights, which are marked in the list "not to be depended upon." A number of the lighthouses on the Central American coast are maintained by an enterprising steamship company.

Around the entire shore line of Bering Sea there is but one lighthouse—that at

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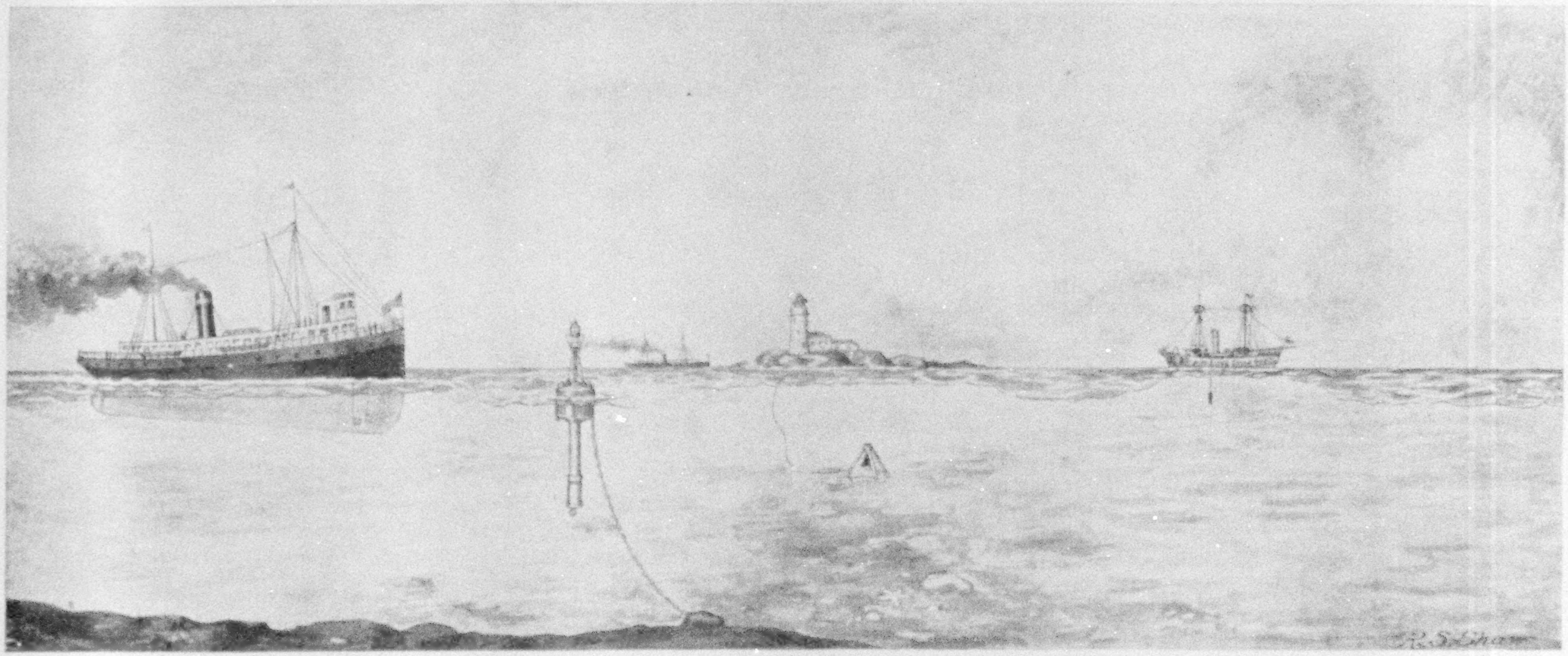

SUBMARINE BELL FOG SIGNALS

The submarine bell is suspended from a light vessel and operated by compressed air, or the bell is mounted on a tripod on the bottom and worked by electric power from the shore, or it is hung from a buoy and actuated by the motion of the sea. Sound is transmitted through the water more uniformly than through the air, and submarine bells have been heard at distances of 15 miles and more by vessels equipped with receiving apparatus.

Cape Sarichef, Alaska—and some small lights near St. Michael; but this is a region where the commerce would not at present justify a costly lighting system, particularly as navigation is mostly confined to the season of no darkness at night.

It seems almost incredible to find, only three centuries ago, powerful opposition to the establishment of lighthouses. In 1619 a heroic Cornish gentleman, Sir John Killegrew, petitioned the king for permission to build a lighthouse on the Lizard, the southernmost point of England, where there is now an electric light whose powerful beam sweeps around the horizon. The nautical board to whom was referred the petition advised the king that it was not "necessarie nor convenient on the Lizard to erect a light, but, *per contra,* inconvenient, both in regard of pirates, or foreign enemys; for the light would serve them as a pilot to conduct and lead them to safe places of landinge; the danger and perill whereof we leave to your majesty's absolute and profound wisdom." Notwithstanding the flattery, James I granted the petition.

Next the local Cornish people opposed the work, as thus told by Killegrew: "The inabytants neer by think they suffer by this erection. They affirme I take away God's grace from them. Their English meaning is that now they shall receive no more benefitt by shipwreck, for this will prevent yt. They have been so long used to repe profitt by the calamyties of the ruin of shipping, that they clayme it heredytarye, and heavely complayne on me." The light was, however, completed and the fire kindled, which, wrote Killegrew, "I presume speaks for yt selfe to the most part of Christendom." But it was impossible to obtain, for supporting it, the "voluntary contributions" from shipping which the king's grant authorized. Finally the corporation of the town of Plymouth pulled down the lighthouse, which the shipowners considered "burthensome to all ye countrie," and there was no light at the Lizard for 132 years thereafter.

Some of the early lights and buoys in England were maintained by religious men. On a tradition of such a philanthropy is founded Southey's ballad regarding the buoy on Bell Rock, where now stands a great lighthouse:

"The good old Abbot of Aberbrothock
Had placed that bell on the Inchcape Rock;
On a buoy, in the storm, it floated and swung,
And over the waves its warning rung.

"When the rock was hid by the surge's swell,
The mariners heard the warning bell;
And then they knew the perilous rock,
And blessed the Abbot of Aberbrothock."

THE DISCOVERY OF CANCER IN PLANTS

An Account of Some Remarkable Experiments by the U. S. Department of Agriculture

With Photographs by Dr. Erwin F. Smith

THERE is no disease to which mankind is liable more productive of intense suffering than cancer, and yet its origin is unknown and no certain method of cure has yet been discovered.

In recent years, particularly during the last decade, the attention of experts in medical research all over the world has been more and more focused upon this subject. Thanks to the munificent coöperation of various public bodies and individual philanthropists, a number of splendidly equipped laboratories have been founded, and international congresses are held from time to time, at which investigators from all parts of the world submit the results of their researches. But, in spite of much patient and laborious investigation, no definite clue has been found, and we are still apparently far from a knowledge of the causes producing this disease.

This is the more unfortunate because, if we may trust the statements of statisticians, cancer is becoming increasingly

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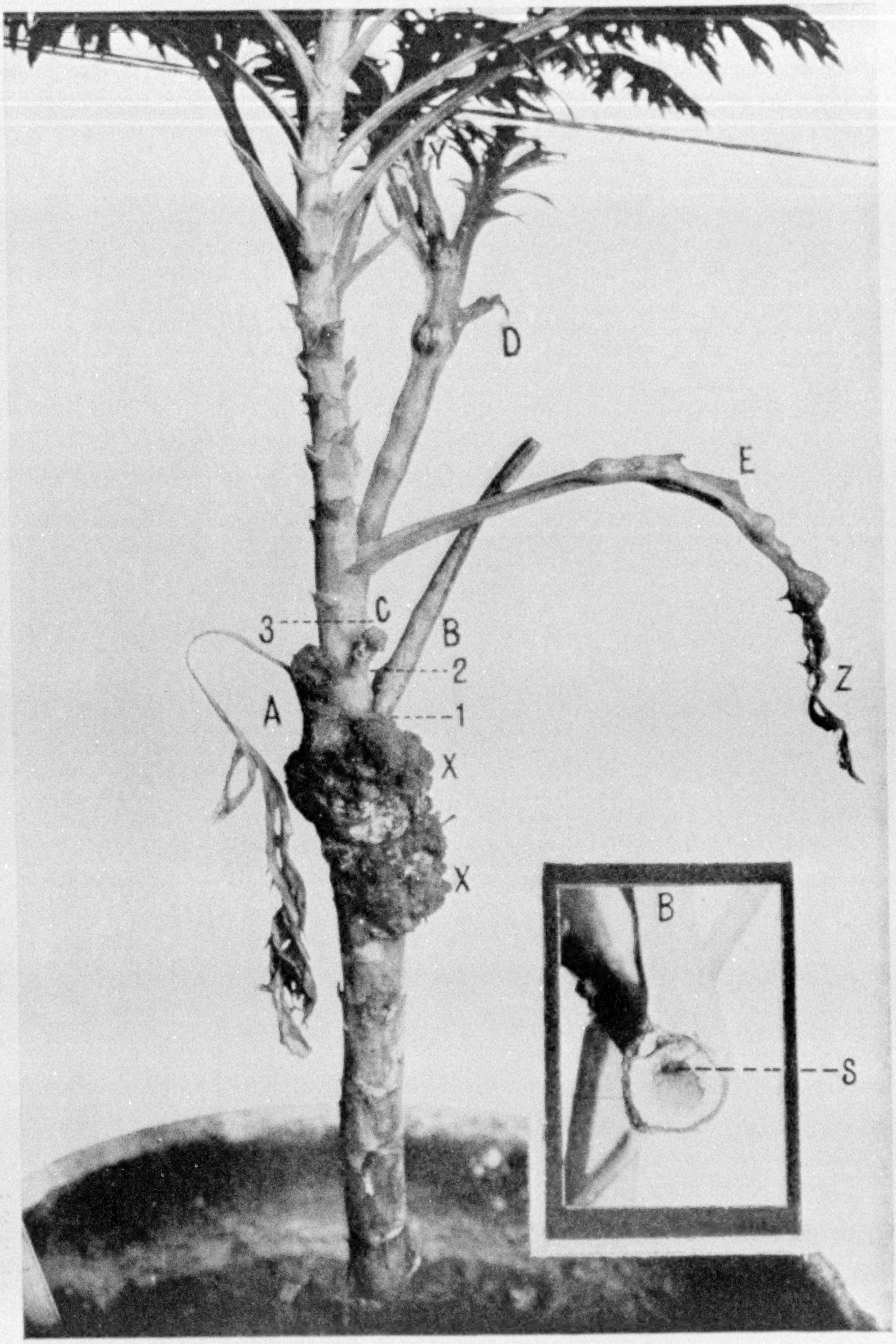

PLATE I. A MARGURITE OR PARIS DAISY IN WHICH PLANT CANCER HAS BEEN PRODUCED BY INOCULATION (SEE PAGE 61)

"A sterilized needle is taken and dipped into the culture containing the bacteria and one or more small pricks are then made in the skin of the plant. After a few days nodules appear."

common. According to the very carefully prepared statistics covering the death rate in England and Wales, it appears that while in every million living in 1871-1875 the annual death rate from cancer was 445 cases, in 1901-1904 the rate had risen to 861 cases. With an increase so appalling, the need of discovering the cause and cure of this disease is urgent.

WHAT THE CELLS ARE

Cancer is a disease of the cells of the body, and to obtain a clear idea of its nature it will be necessary to consider very briefly the cells as the living units of protoplasm, of which all bodies, both of plants and animals, are composed. For example, the human body has its origin in the union of two small cells, and the single cell thus produced divides in its turn into two, these two into four, each cell dividing upon an arithmetical progression of 2 . 4 . 8 . 16 . 32 . . . . with incredible rapidity. Some conception of the diminutive size of these cells can be formed when we know that ten days after the union of the original male and female cells the cell-structure, which will ultimately develop into the human body, has attained the size of a pin's head, yet it contains hundreds of thousands of cells.

All cells act automatically and reproduce themselves under internal or external stimulus, but only in accordance with the needs of the body to which they belong. Just what that stimulus is and how it is caused is still a matter of some obscurity, but recent researches by Dr. Alexis Carrel, of New York, and many others tend to show that all normal cell stimulation, as far as the human body is concerned, is due to secretions produced by certain cell-groups, such as the pancreas, the thyroid, and other glands.

So long as this automatic self-division of cells, or proliferation, as it is called, coincides with the needs of the body, a normal condition exists.

HOW A CANCER BEGINS

A cancer results from an abnormal proliferation of certain of these cells. When from some still unknown reason a cell is stimulated to abnormal, malignant proliferation it becomes the mother cell of the cancer and gives rise to daughter cells, which often multiply with immense rapidity and so on indefinitely. These abnormal cells also react upon normal cells and stimulate them also into rapid growth until the typical cancer is formed.

A great number of theories have been put forward to account for this abnormal cell growth, the more important being the following: Virchow's theory, which attributes all tumors and cancer to the direct results of injury or irritation; Cohnheim's theory, which accounts for cancer by a supposition that during embryonic life certain cells are isolated or "displaced from their normal relationship or fail to undergo normal atrophy" (Adami, Principles of Pathology, vol. 1, p. 835), the result being that they lie dormant until roused into activity by some stimulus, and that, having the enormous power of proliferation which characterizes all embryonic cells, they outstrip the adult cells and a cancer results.

Those who maintain these and other theories of the non-parasitic origin of cancer, and they constitute at present the major part of all research workers in the field of cancer, have always maintained that this disease cannot be parasitic, not only because no one has ever been able to isolate or demonstrate any parasite, but also, they claim, because the cancer cell is itself the parasite. Cancer, as of rats, mice, etc., cannot be reproduced, they have said, except by the introduction into the animal experimented upon of living cancer cells, usually from another animal of the same species.

THE PARASITIC THEORY

The parasitic theory, however, has enthusiastic supporters, and is still a matter which excites keen discussion in medical circles. As will be shown later, it is along this line that present indications show the greatest promise of future results. This theory holds that cancer is due to an abnormal stimulation produced by some still undiscovered micro-organism, and its adherents point out that cancer, with its localized primary growth and widespread secondary infections, bears a remarkable similarity to

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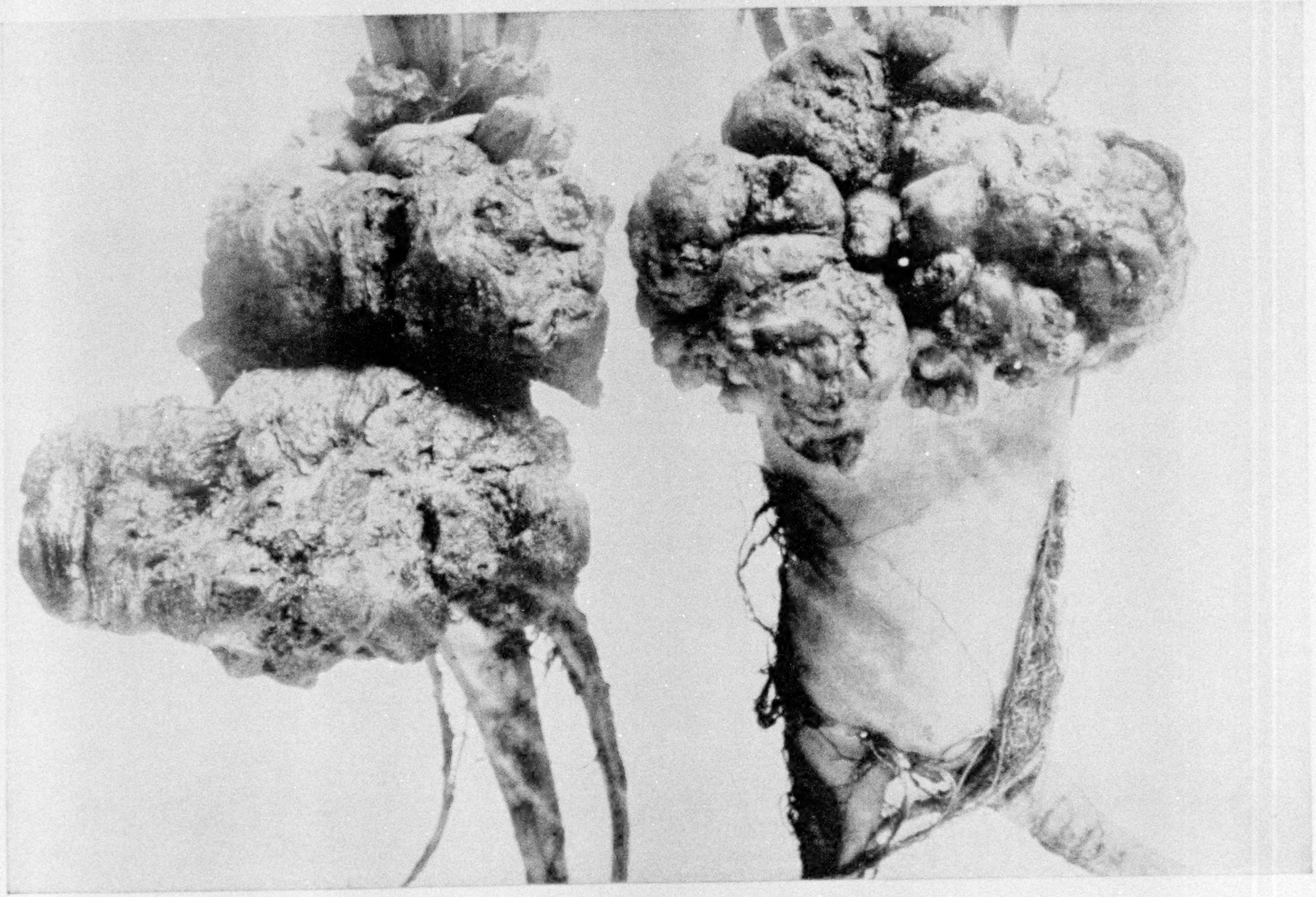

PLATE II. PLANT CANCERS PRODUCED BY INOCULATION ON SUGAR BEETS: PHOTOGRAPHED TWO MONTHS AFTER INOCULATION TO SHOW THE RAPIDITY OF THE MALIGNANT GROWTH (SEE PAGE 61)

certain other diseases which are known to be of parasitic origin.

Dr. Borrel, of the Pasteur Institute, has found animal parasites (acarids) buried in the cell masses of certain cancers of the face, and he conceives that possibly these parasites introduce an organism or a poison much in the same way as the mosquito introduces the malaria virus into the system. Still more recently (1911-1912) Dr. Peyton Rouse has announced* that a chicken sarcoma (cancer) is inoculable in the absence of cancer cells, and that the tumor material, even when dried for six months, is still infectious.

THE LATEST DISCOVERY

But perhaps the strongest support of the parasitic theory of cancer has come from what at first sight would seem to be the most unlikely source, namely, the Bureau of Plant Industry of the U. S. Department of Agriculture. This, however, is not so remarkable when we remember that cancer is a disease resulting from abnormal cell stimulation, and that the cell is substantially the same in both plants and animals.

Indeed it is to comparative pathology that we must look for the most striking results of our future investigation.

For some nine years past Dr. Erwin F. Smith, the pathologist in charge of the Laboratory of Plant Pathology of the Department of Agriculture, and his assistants have been conducting a series of investigations into the origin and histology of the crown gall.

The crown gall is a plant disease which causes an annual loss to farmers of millions of dollars and has become a serious problem to the agriculturist on account of the number of species of plants liable to its ravages. It is known to attack the daisy, the almond, peach, and other stone fruits, the apple, quince, raspberry, blackberry, the rose, the grape, red clover, alfalfa, cotton, hops, sugar-beets, and various shrubs, hot-house plants, and shade trees. Up to the time that Dr. Smith undertook his investigations its cause and character were entirely unknown.

A NEW BACILLUS FOUND

He has proved the parasitic nature of this disease (Bulletin 213), and now states (Bulletin 255) that it is nothing more or less than a plant cancer, since it is due to parasitic stimulation going on within the cells and leading to abnormal proliferations essentially like those present in cancer of men and animals.

While Dr. Smith has surrounded his conclusions with all those qualifications so dear to the modesty of the scientist, there is no doubt that he has made a discovery of the first magnitude in pathology, and has indicated a line of research which investigators of human cancer will be unable to ignore.

In 1904 the Department of Agriculture received a number of margurites, or Paris daisy plants, which were infected with gall-like growths on the stems and leaves. They were sent in to the Department by one of the large commercial growers in New Jersey, accompanied by the statement that the galls appeared, without apparent cause, both on plants grown in the open in summer and under glass in winter.

HOW THE DAISY HELPED

The first result obtained from the investigations undertaken by Dr. Smith was the establishment of the fact that these growths were not due to insect injuries. The next step was to discover whether the galls were due to infection by fungous growths, and this was decided in the negative after very conclusive experiments. The possibility of these growths being due to bacteria next presented itself and was investigated, but for some time the results obtained from the experiments were so inconclusive that the bacterial hypothesis was temporarily abandoned. Every effort was then made to produce the galls by mechanical injuries practised upon the plants in every stage of growth, but experiments in this direction were fruitless.

More than two years of careful investigation had been consumed before Dr. Smith and his assistants were able, by bacteriological culture-methods, to isolate any organism which would reproduce the disease when plants were inoculated

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* Journal American Medical Association; American Association for Cancer Research; Journal Experimental Medicine.

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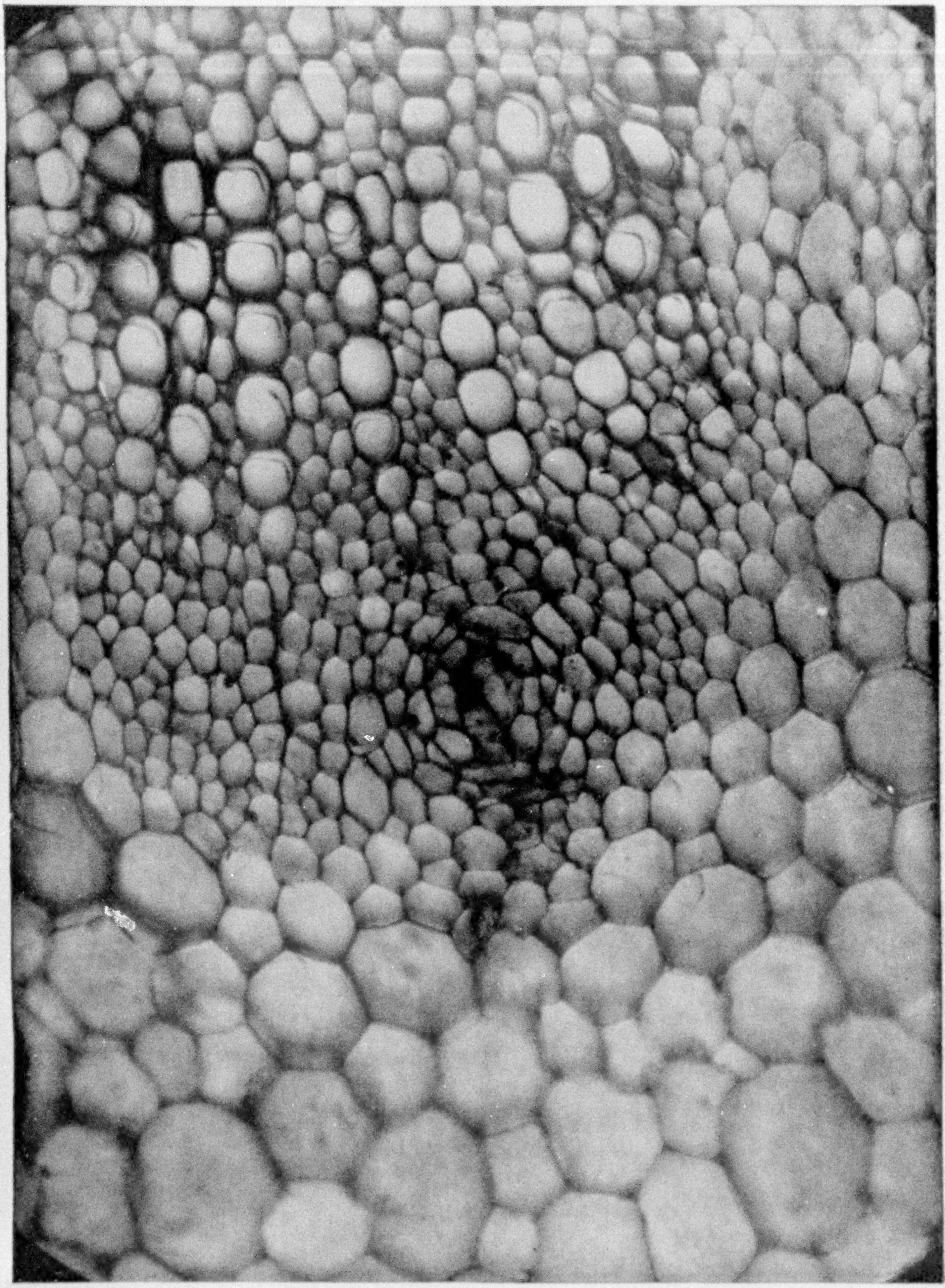

PLATE III. A CROSS-SECTION OF A PLANT SHOWING BOTH NORMAL AND DISEASED CELLS (SEE PAGE 61)

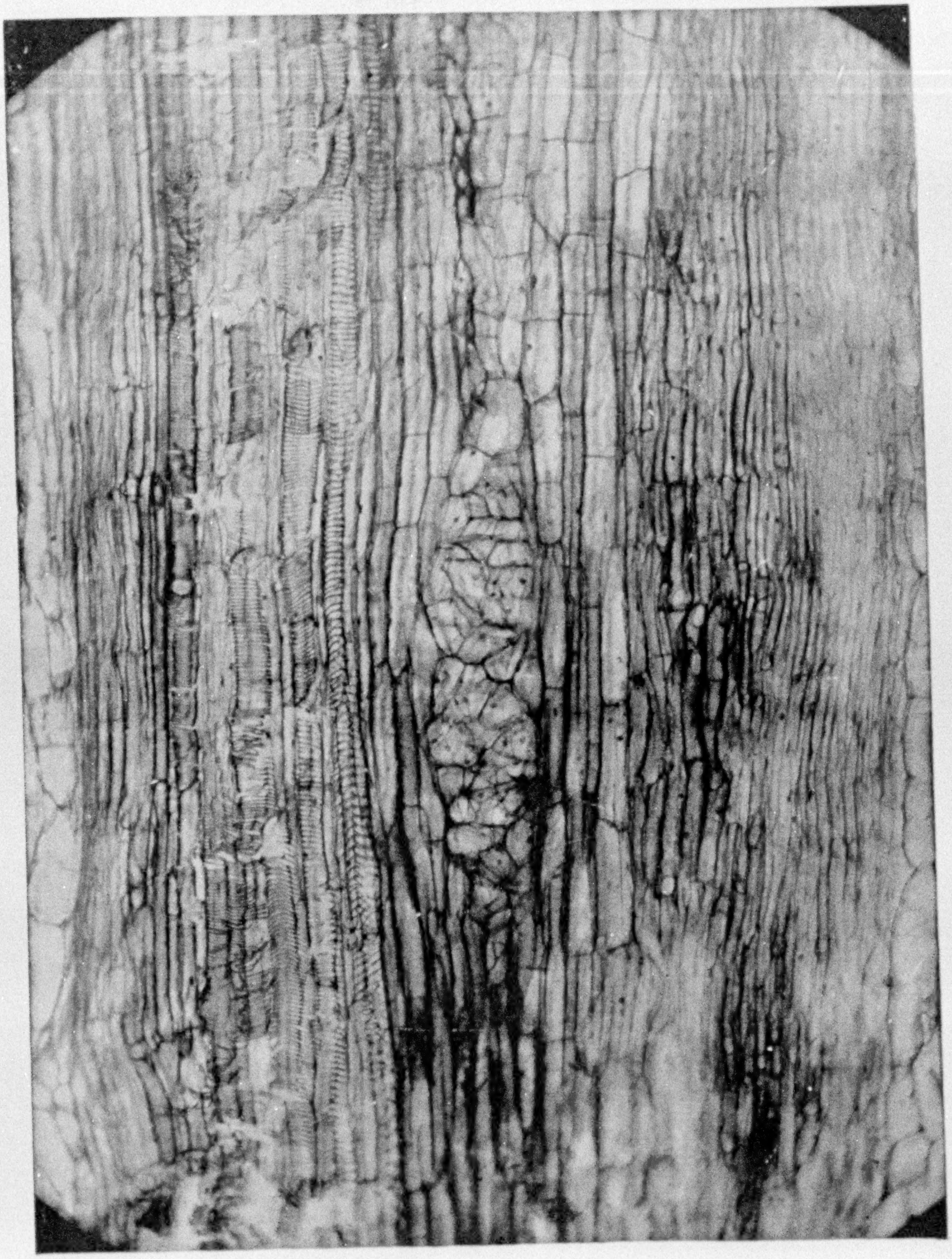

PLATE IV. A LONGITUDINAL SECTION SHOWING HEALTHY AND DISEASED CELLS IN THE SAME PART OF THE PLANT STEM AS SHOWN IN PRECEDING PHOTOGRAPH (SEE PAGE 66)

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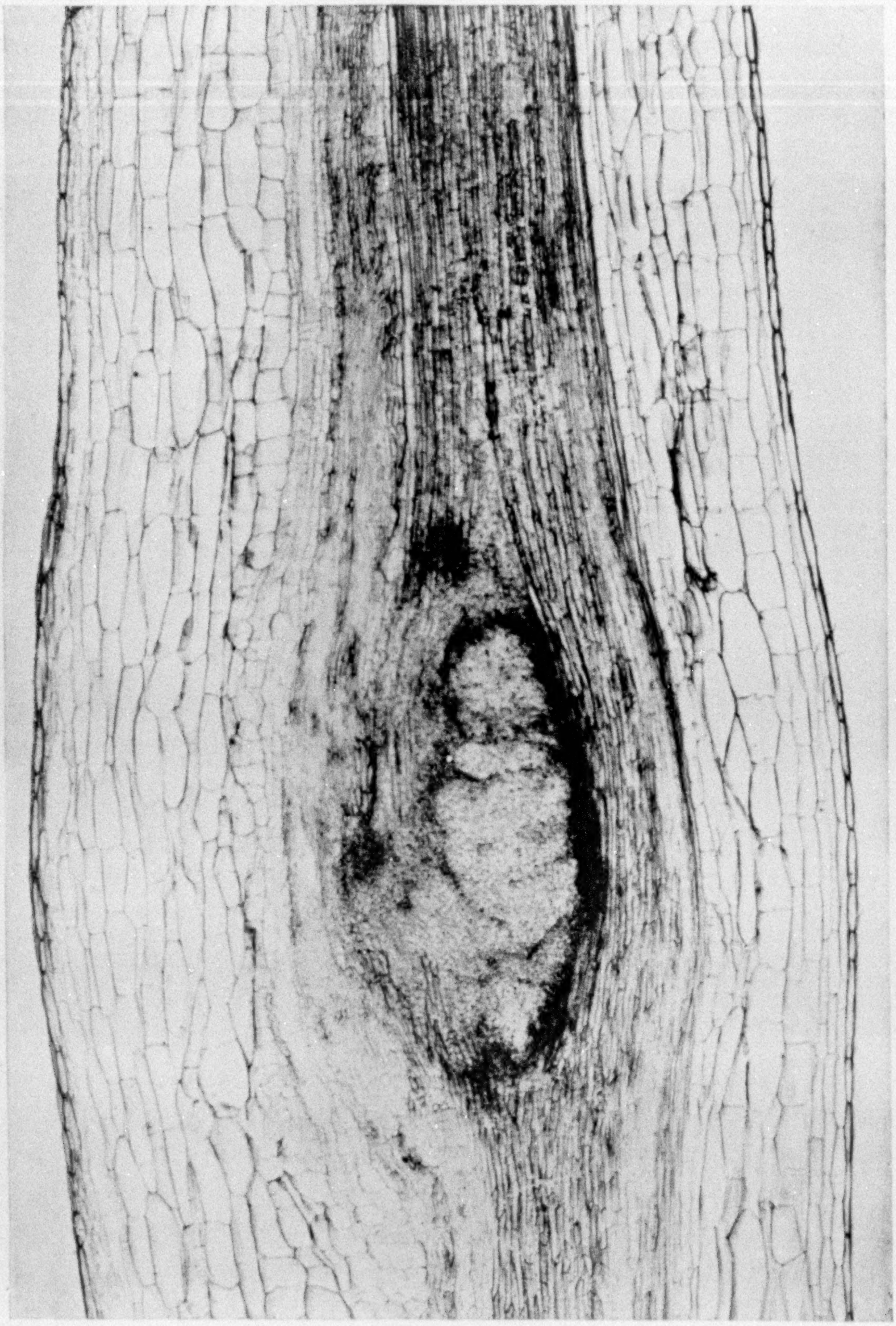

PLATE V. THE EFFECT OF THE CONTINUED ABNORMAL GROWTH OF THE CANCER CELLS IS SHOWN IN THIS LONGITUDINAL SECTION OF A PLANT STEM

The tumor in course of formation is very apparent (see page 66) with it. They finally succeeded in separating a white bacterio-organism found in the tumors which they discovered would produce the crown gall when introduced into a healthy plant. This they have named the *Bacterium tumefaciens*, or tumor-producing organism.

Subsequent experiments showed that the most uniform success followed experiments upon young and rapidly growing plants, it being often possible to obtain 100 per cent of infections. But eight years passed before they were able satisfactorily to stain the organism in the tissues so that it could be demonstrated under the microscope.

Still further work was necessary before Dr. Smith was convinced that the time had come when this disease could be properly described as plant cancer.

THE PLANT CANCER DISCOVERED

These results have been announced in two luminous bulletins of the Bureau of Plant Industry, Nos. 213 and 255, containing a series of admirable photographs and photo-micrographs, which show the plant cancer in all its variations.

With the aid of some of these photographs, we will follow Dr. Smith through one of his experiments, showing how the cancer is produced; how it sends out tumor-strands from the original point of infection; how secondary cancers develop from these tumor-strands; also the different structure of primary and secondary leaf tumors, and finally we shall see both the disturbance produced in the normal cell structure and the *Bacterium tumefaciens*, which is responsible for the trouble.

In Plate I (page 54) we have one of the Paris daisies, or margurites, which served as the medium for very many important experiments. A sterilized needle is taken and dipped into the culture containing the bacteria, and one or more small pricks are then made in the skin of the plant. After a few days nodules appear, which finally grow into the primary cancer, producing the malformations shown in this plant at the points marked X, where the inoculations were made. From this point the cancer begins to throw out its roots or tumor-strands, which work their way up and down the stem and into the leaves, throwing off secondary cancers as they pass. These secondary cancers can be plainly seen at the points marked A and C, where they have ruptured to the surface, while a number of them, still buried in the normal tissues, are visible along the leaf E, with others at D.

In the right-hand corner of the plate there is a cross-section of the stem taken at the point marked 1, which shows how a large tumor-strand (marked S) appears to the naked eye.

WHAT A TUMOR-STRAND IS

This tumor-strand is of great importance in determining the cancerous nature of the gall disease. In the Encyclopædia Britannica, Dr. Louis Courtland says: "A cancer follows a course very different from that of an innocent tumor. Its growth has no appointed termination, but continues with unabated vigour until death; moreover, it is more rapid than that of the innocent tumours, and so does not permit of the formation of a capsule by the neighboring tissues. In consequence such a tumour shows no well-defined boundary, *but from its margin fine tendrils of cancer cells make their way in all directions into the surrounding parts*, which gradually become more and more involved in the process. Thus a cancer of the breast will attack both the skin covering it and the underlying muscle and bone; a cancer of the intestine will eat its way into the liver, spleen and kidney, until these organs become to a great extent replaced by cancer cells, and can no longer perform their proper functions."

In this tumor-strand, therefore, we find just exactly what we should expect to find in a plant suffering from cancer. The enormous rapidity with which plant cancers may develop is shown on Plate II, which exhibits two sugar-beets inoculated by needle pricks with pure culture, the photograph being made only two months after the roots were infected.

WHAT CELLS LOOK LIKE

We will now turn to Plate III and see how the tumor-strand disturbs the normal cell structure. This plate shows a

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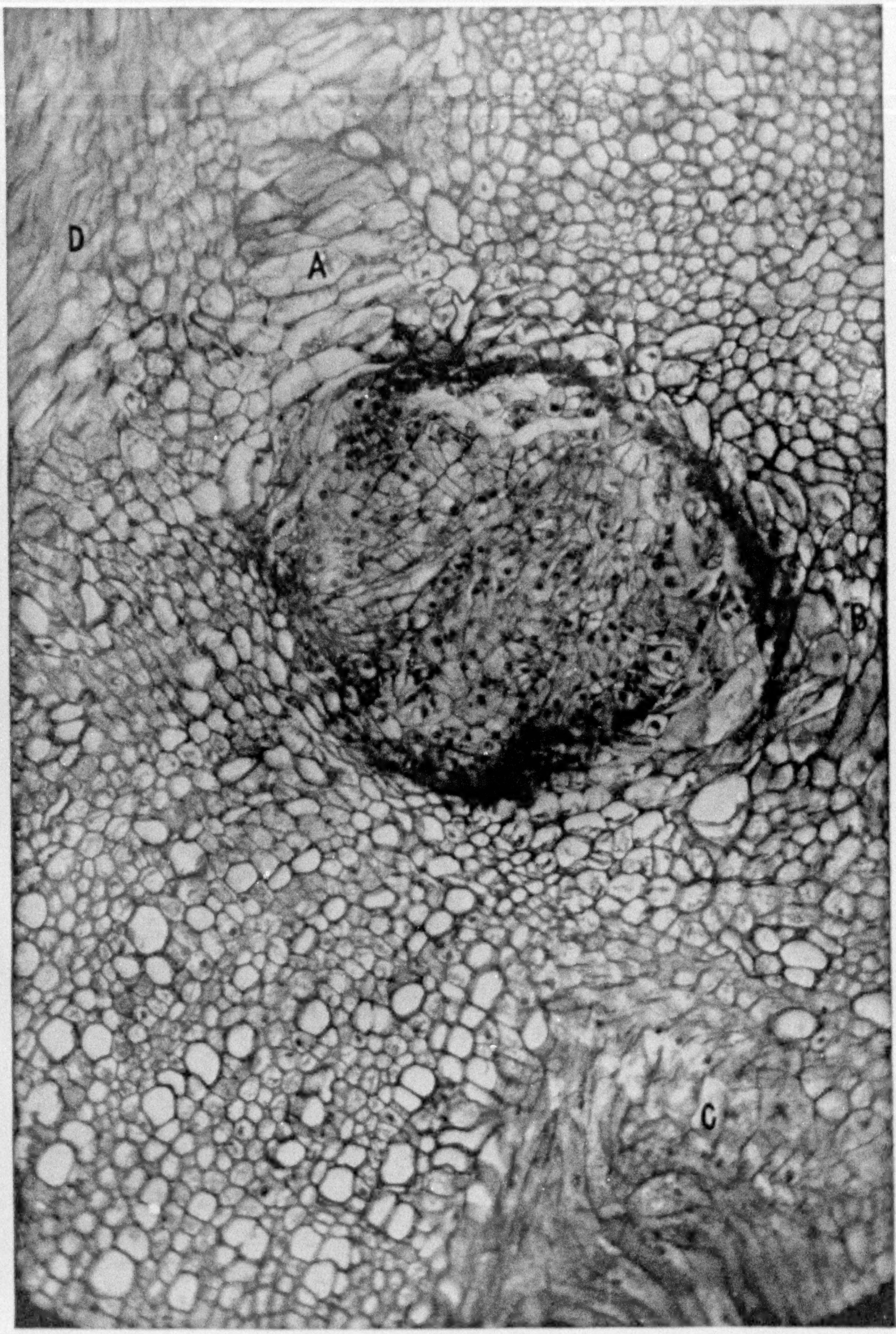

PLATE VI. THE CANCER ROOT OR TUMOR-STRAND AS IT LIES IN THE SURROUNDING TISSUE, SHOWING THE NUCLEI OR POINTS FROM WHICH CELL DEVELOPMENT STARTS (SEE PAGE 66)

Note the black spots in this and the following photograph. These spots are the nuclei or points from which the proliferation starts, due to the stimulation of the parasite

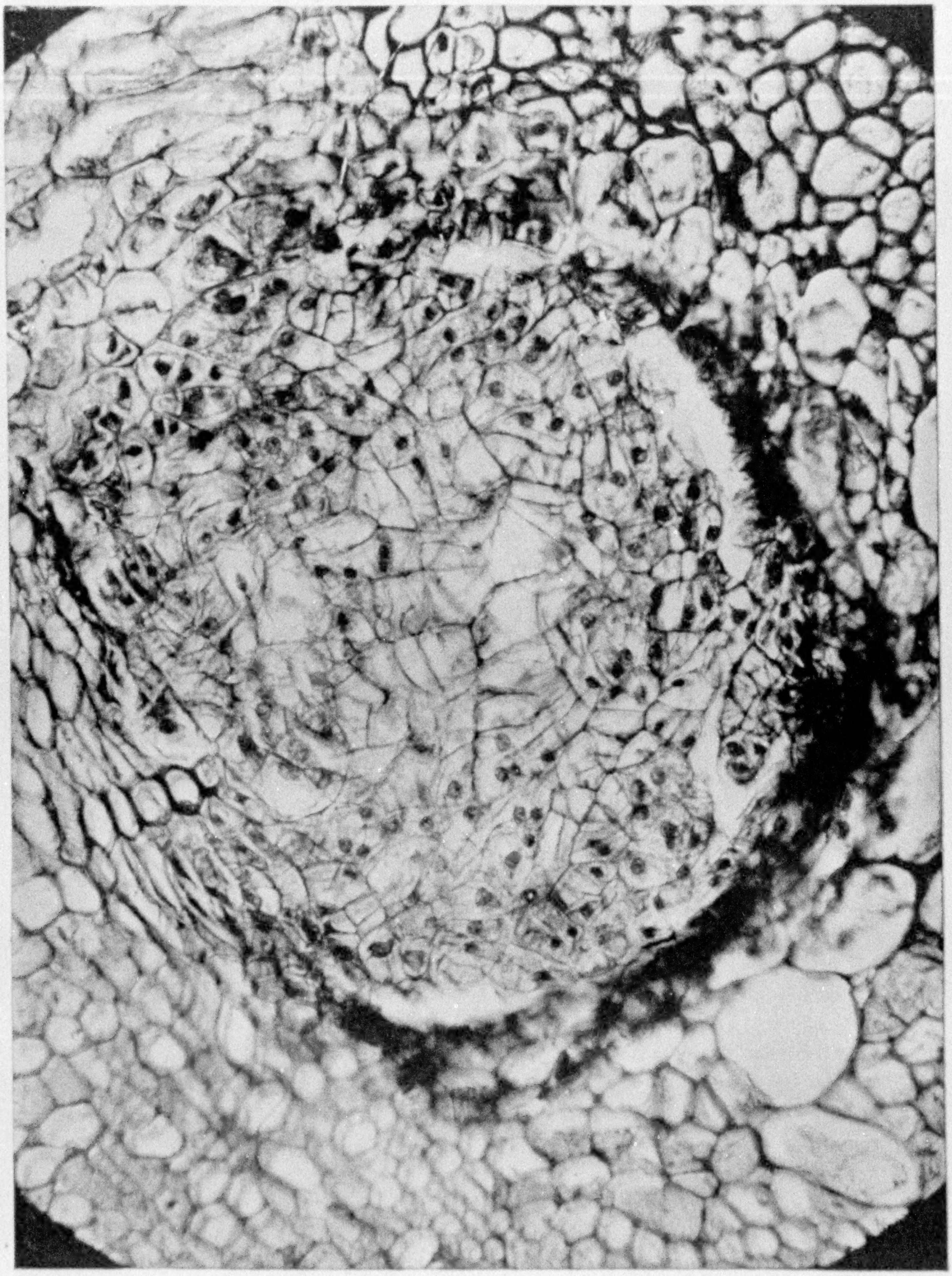

PLATE VII. AN ENLARGEMENT OF THE TUMOR-STRAND SHOWN IN THE PREVIOUS PLATE, SHOWING A CLEARER VIEW OF THE NUCLEI

Note the black spots, or centers of activity, are very prominent (see preceding plate)

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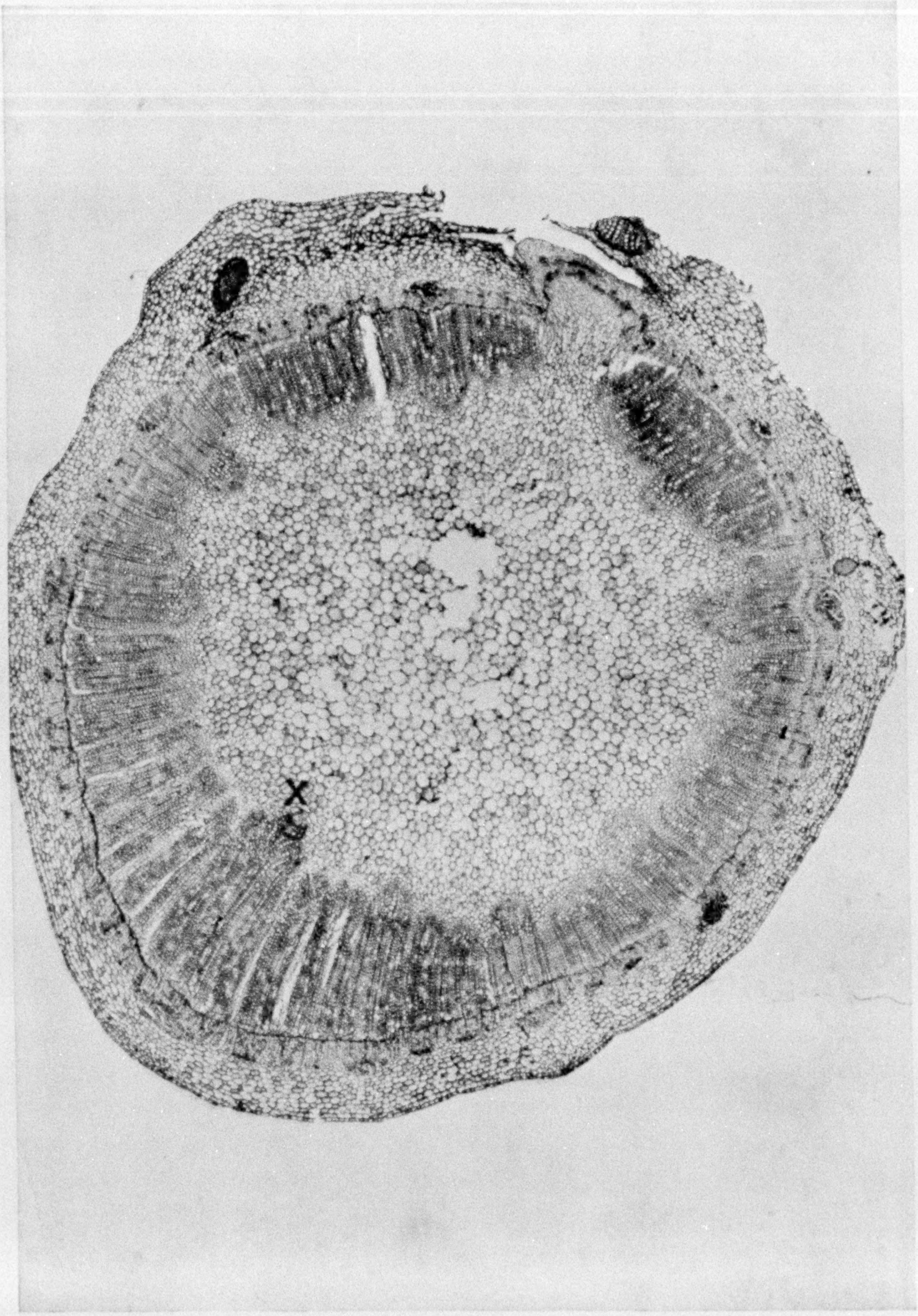

PLATE VIII. THE CROSS-SECTION OF A STEM BETWEEN TWO TUMORS, SHOWING THE SMALL TUMOR-STRAND (AT POINT X) WHICH CONNECTS THEM (P. 66)

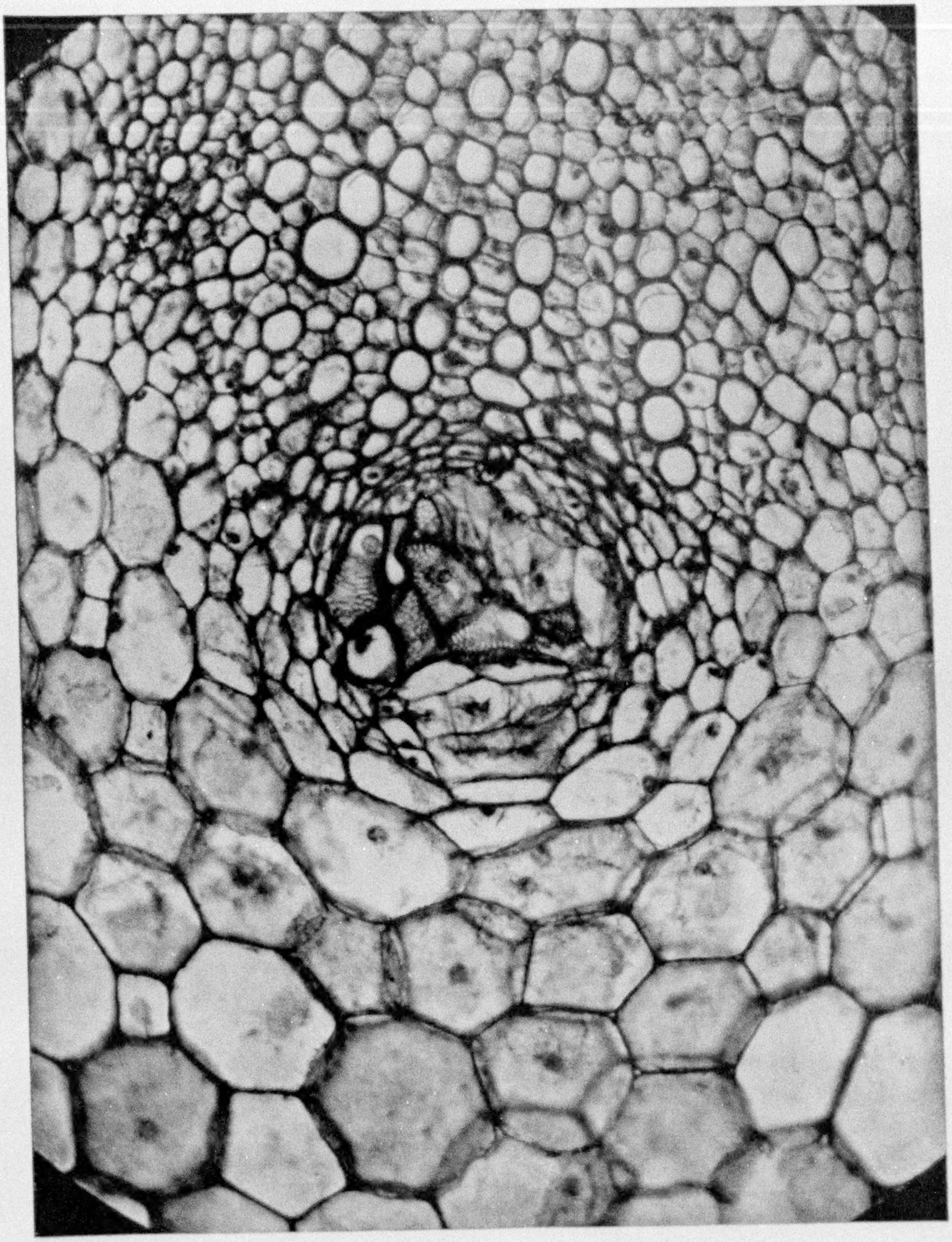

PLATE IX. AN ENLARGED PHOTOGRAPH OF THE SMALL TUMOR-STRAND OF THE PREVIOUS PLATE

Showing how the cells have been displaced from their normal relationship, which supports Cohnheim's hypothesis (see pages 55 and 66)

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typical cell formation in the stem of a plant as it appears in a cross-section or looking down upon it from above. This is a photo-micrograph, and the tiny cells have been magnified until, taken collectively, they look like a cobblestone pavement; but we can now see how the cells look when they are subject to both normal and abnormal stimulation. The great majority of the cells shown here are behaving quite normally, but in the center of the picture, where the large pith-cells join the smaller wood-cells, we notice a little group of cells which seem to be different from the others and to be forming a little circular colony of their own. These are the cells which, under the stimulus of the cancer bacillus, form the tumor-strand.

Just how abnormally these cells are behaving will be immediately apparent when we view a tumor-strand in longitudinal section or in a front view as given in Plate IV. Here the cells in the tumor-strand, which is shown in the center of the plate and looks not unlike a sweetbread, have a markedly different appearance from those of the normal tissue surrounding them. The effect of their continued abnormal growth is shown in Plate V, where a young tumor is developing, while a more detailed photograph of a cross-section of a tumor-strand lying in the midst of less abnormal cells is shown on Plate VI.

THE NUCLEUS AND ITS FUNCTION

This is a particularly interesting plate, as it shows that the tumor-strand, just like many human cancers, has a strong affinity for the stain used upon the microscope slide, and this shows especially at the edges of the strand, which appear quite dark. A series of small black spots will also be observed, very numerous in the cells in the tumor-strand and appearing at intervals in a few cells on other parts of the plate. These spots are the nuclei or points from which proliferation starts, and the superabundant proliferation in the tumor-strand, due to the stimulation of the parasite, can be easily seen.

An enlargement of the tumor-strand area is given in Plate VII, which affords a much clearer view of the nuclei. It will be observed that these points of proliferation are distributed all over the tumor-strand area, but are especially numerous at the edges.

Plate VIII shows a cross-section of the stem of a daisy plant between the primary and secondary tumors. The tumor-strand occurs at the point x, and the rest of the stem is quite normal except for a slight thickening of the ring of wood-cells at the point nearest the tumor-strand.

An enlargement of this tumor-strand and the surrounding cells appears in Plate IX, the tumor-strand being at the junction of the small wood-cells above and the larger pith-cells below. Here in the tumor-strand we have the cells "displaced from their normal relationship," referred to in Cohnheim's hypotheses (see p. 55), the pitted portion being vessels (trachids) which have developed out of place and still contain nuclei which are absent from these vessels when fully developed. They also show, by their feeble staining, that they are still in process of of development, as adult vessels of this type usually stain heavily.

HOW PLANT CANCER DESTROYS TISSUE

A cross-section of a leaf stalk in which a tumor has developed is shown in Plate X. The ravages of the cancer can be appreciated when we realize that the light-colored cells at the top and left are all that is left of the normal tissue. This is a secondary tumor developed from a tumor-strand which has pushed its way up from a primary tumor situated on the stem below, and consequently it has an imperfect stem structure, consisting of a central tumor-strand, which takes the place normally occupied by the pith. From it radiate in all directions woody plates (the dark rays in the picture), separated by enlarged pith rays (the light rays), the whole being inclosed by a ring of bark cells. The great excess of soft cells leading to rapid decay and the absence of pith are the chief differences between this and a normal stem.

The very striking contrast between such a secondary leaf tumor and a primary leaf tumor can be seen in Plate XI, which is a cross-section of a primary leaf tumor produced from a pure culture

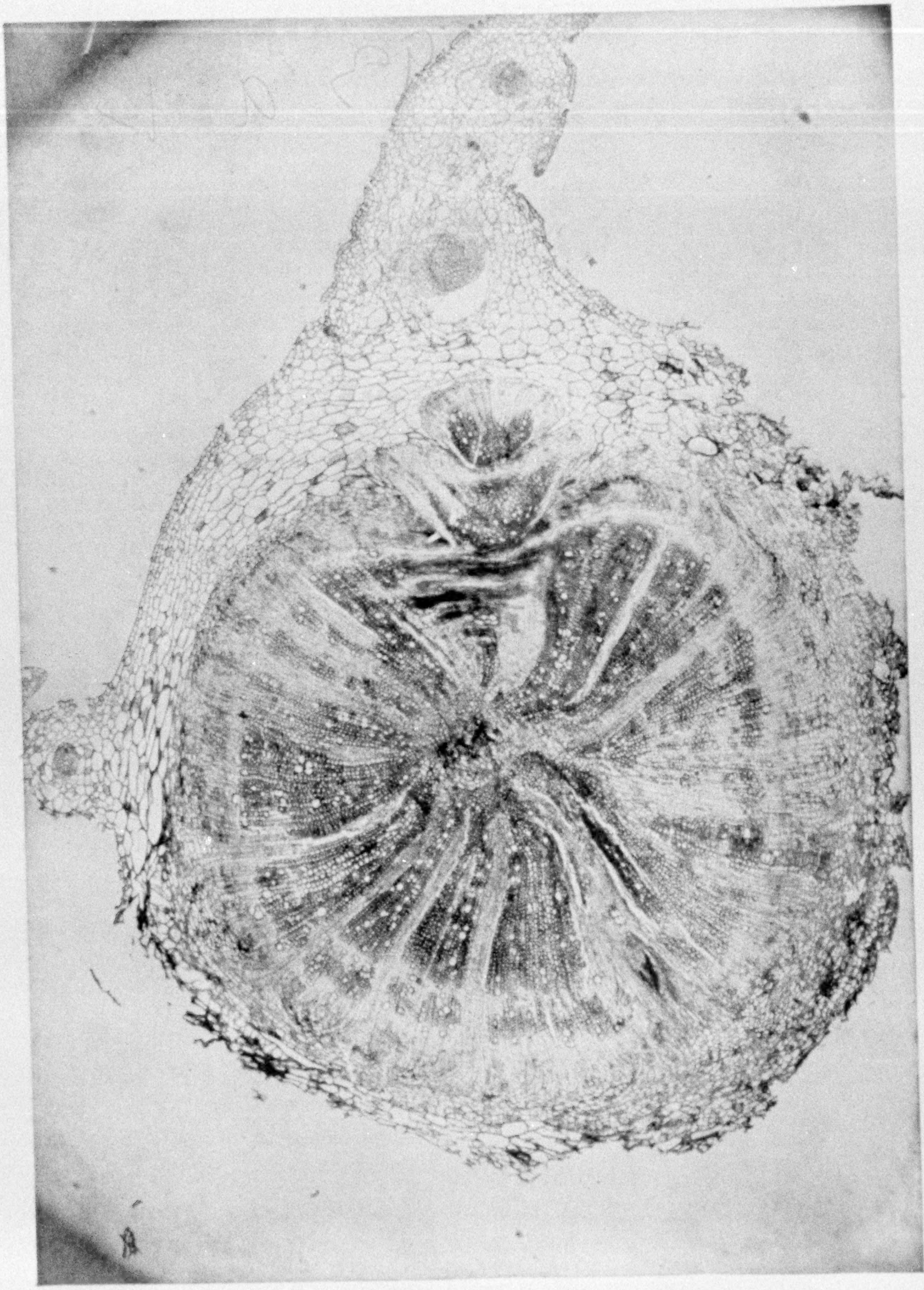

PLATE X. A CROSS-SECTION OF A LEAF STALK IN WHICH ALMOST ALL THE NORMAL CELLS HAVE BEEN EATEN AWAY BY THE CANCER (SEE PAGE 66)

XUM

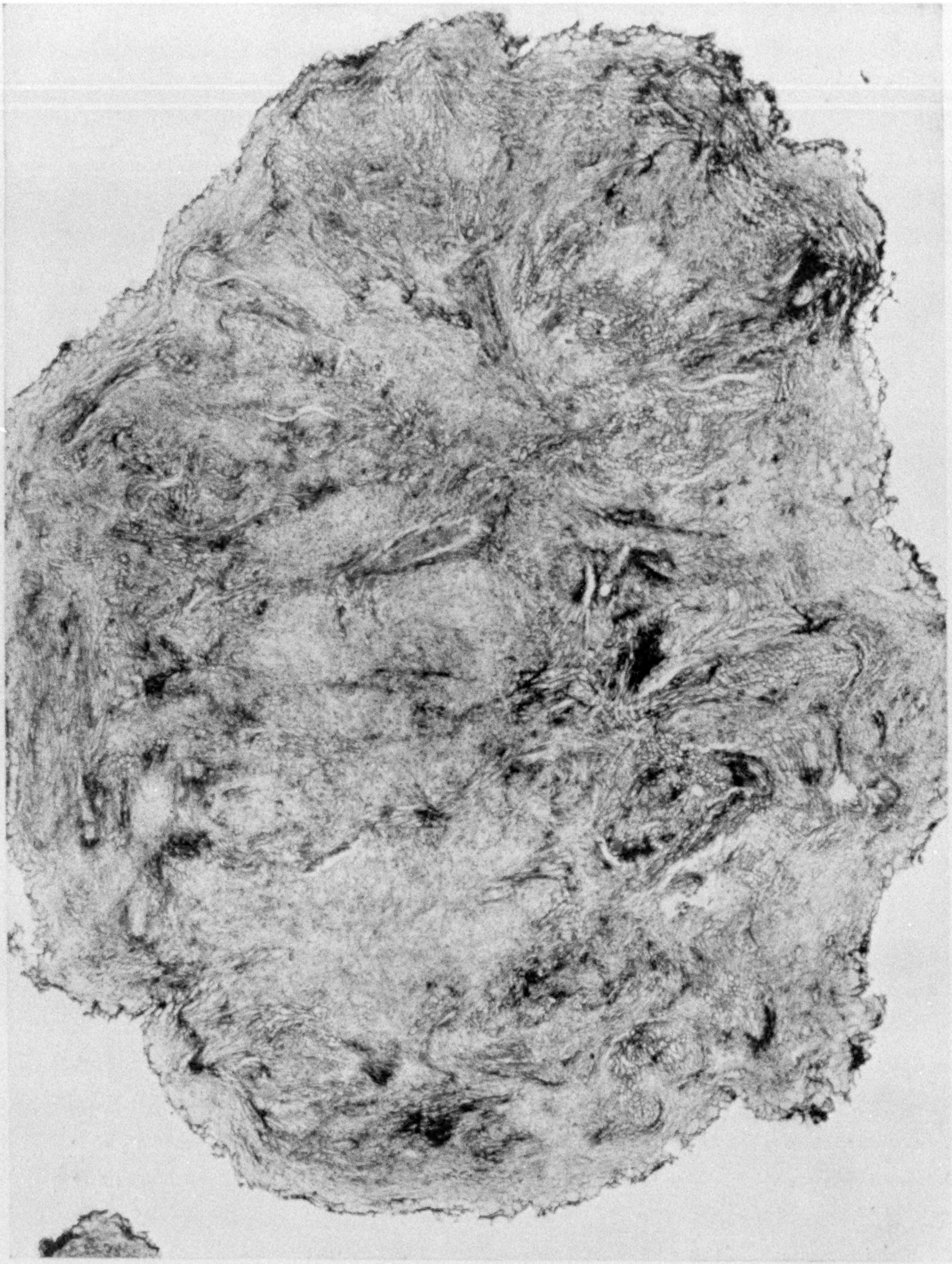

PLATE XI. CROSS-SECTION OF A LEAF TUMOR PRODUCED IN THE LEAF FROM A PURE CULTURE BY A SINGLE NEEDLE PRICK (SEE PAGE 66)

No normal cells remain; the whole body is a tumor composed of fleshy tissue and woody fiber

XUN

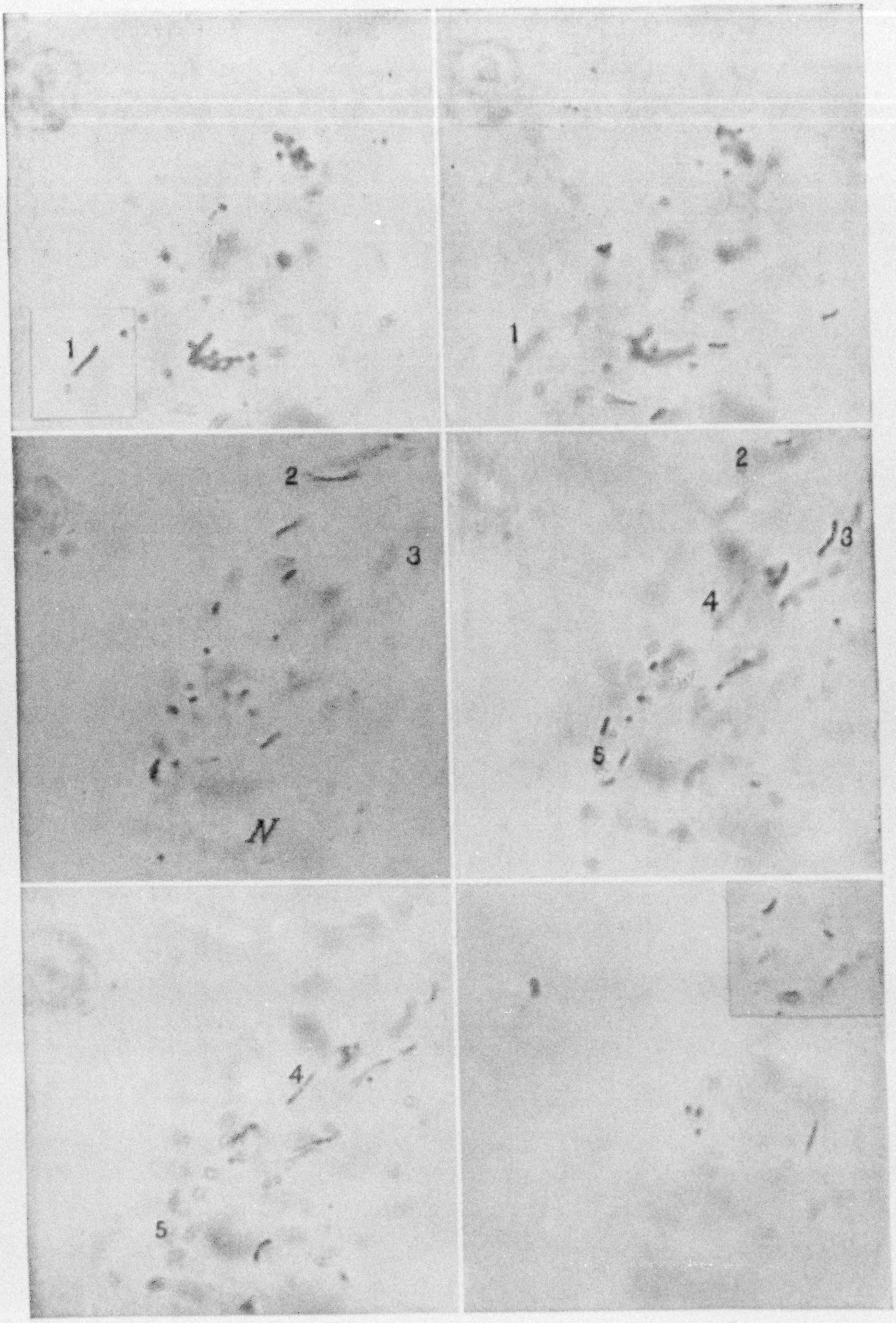

PLATE XII. PHOTO-MICROGRAPH OF EIGHT LEVELS IN A CELL, SHOWING THE ROD-LIKE ORGANISM WHICH PRODUCES PLANT CANCER, THE *Bacterium tumefaciens,* AS IT APPEARS UNDER THE MICROSCOPE

These bacteria are from a daisy tumor

XUM

by a single needle prick on a healthy leaf. Here no normal cells remain; the whole body is a tumor composed of fleshy tissue and woody fiber, the minute dots all over the picture being the nuclei of the tumor cells, from which further proliferation will take place.

It is not a simple matter to obtain photo-micrographs showing the bacteria actually in the cells, but on Plate XII we have photographs of eight different levels in a cell, and the irregular rod-like bacteria are easily distinguishable. These bacteria are described by Dr. Smith as follows: "The galls on Paris daisy are due to a white schizomycete named *Bacterium tumefaciens*. This organism is a short rod multiplying by fission and motile by means of a polar flagellum. It can be grown in many sorts of culture media, but does not live very long upon agar. It forms small, round, white colonies in agar or gelatin poured plate."

HOW THE PARASITE WORKS

The fight between the infected cell and the bacillus is most interesting, and shows how the cell responds to the stimulation and reproduces itself. This is how Dr. Smith conceives it to take place:

"The relation between host and parasite in this disease may be regarded as a symbiosis (or condition in which two dissimilar organisms live together), in which the bacterium has the advantage. The bacterium derives its food from the cells of the host and drives them at a breakneck speed. It gives to them in return its waste carbon dioxide for the use of their chloroplasts." (Chloroplasts are the bodies in the cell which contain chlorophyll or green coloring matter, and are the most important bodies concerned in the making of starch from the water in the cell and the carbon dioxide of the air.) "The bacterium does not destroy the cells of the host, but only stimulates them into an abnormal and often exceedingly rapid division.

"This stimulus, it would seem, takes place through the following delicate adjustment of opposing forces: Within the host cell the sensitive parasite produces as one of its by-products an acid. As this acid accumulates it stops the growth of the bacteria and destroys a portion of them without, however, destroying the host cell. The membranes of these dead bacteria, which have now become permeable, allow the diffusion into the host cell of bacterial endotoxines." (Endotoxines are poisons produced by the bacteria, but held within them while alive, and only escaping when the membranes of the dead bacteria disintegrate.)

THE CELL DIVIDES

"The host cell now contains, of abnormal bacterial products, (*a*) these escaped endotoxines, (*b*) a certain amount of weak acid (acetic ?), (*c*) some ammonia, and (*d*) an excess of carbon dioxide. Under the stimulus of one or more of these poisons the nucleus (or point from which proliferation commences) divides by mitosis (the usual but more complex of the two methods by which cells multiply). In process of division the nuclear membrane (the envelope inclosing the nucleus) disappears and the contents of the nucleus flows out into the cell. The dormant bacteria under the stimulus of this nuclear substance renew their activities in the daughter cells until again inhibited, whereupon the daughter cells divide. By this rocking balance, in which first the parasite and then the host cell has the advantage, the tumor develops rapidly and independently of the needs of the plant."

This rapid growth of the tumor, independently of the needs of the plant, and the tumor-strand, which produces the secondary tumors with structure of the primary tumor, show very clearly the cancerous nature of the disease, and its development closely parallels what takes place in cancer in men and animals.

Dr. Smith is very careful to point out that he considers that his discoveries have no absolutely direct bearing upon human cancer, and the following closing words are characteristic:

"Nothing in this bulletin should be construed as indicating that we think the organism causing crown galls is able to cause human cancer, but only that we believe the latter due to a cell parasite of some sort."

FROM JERUSALEM TO ALEPPO

Being the experiences and impressions of the writer while making a trip starting from Jerusalem via Jaffa and Tripoli of Syria to the Cedars of Lebanon, through the Lebanon pass to Baalbek, and on to Homs, Hama, and Aleppo, during the months of August and September, 1912, and illustrated by photographs taken specially on the trip by members of the American colony.

BY JOHN D. WHITING, OF THE AMERICAN COLONY, JERUSALEM

THE chief boatman at Jaffa called out "Yalla! Yalla!" to his men, who were making their way deliberately to the large row-boat in which we were seated. The steamer was soon to leave, and the call of the chief had the result of electrifying the men, and in a few moments eight brown, muscular boatmen were pulling us through the narrow opening between the rocks to which tradition states Andromeda was chained, to be eaten by a sea monster.

These rocks have been the terror of pilgrims and tourists for centuries, but the Jaffa boatmen are renowned for their skill as well as courage and endurance.

We were now able to compose ourselves and count our packages. We had only decided after dinner the evening before to take the trip, and Mr. Larson and Mr. Baldwin, my two companions, were up all hours of the night getting ready. Yes, the pieces were there; thirteen in all.

It might seem strange for three men to need so much baggage, but the fact is we had only two small suit-cases between us, and the balance was photographic apparatus of all kinds and a couple of heavy boxes of plates.

A few hours of slow steaming brought us round the promontory of Mount Carmel, which figures so largely in Old Testament history, and which, since Haifa during the past half century has grown so rapidly in importance, has become quite a summer resort.

The sun was almost setting as the large barges were being filled and emptied as fast as possible by yelling Arabs, who can do no sort of work without exercising their lungs as well as muscles.

THE SYRIAN EMIGRANT

The lower decks of the steamer were packed with steerage or deck passengers, who, from the time we were nearing Beirut, occupied themselves in arranging their toilet preparatory to disembarking.

From their appearance many could have been taken for Italians, but one had only to watch a few moments to see that they were Syrians who had been seeking their fortunes in America. Suit-cases and ponderous trunks were opened, disclosing a mixture of old clothes, silk dresses, patent-leather shoes of distinctive American type, onions, garlic, bread, and the like, thrown in together with true Arab shiftlessness. Their attire and talk disclosed that they were just returning from various parts of America, and their gala dress and glad faces that they were nearing their native homes.

The entire costumes of both men and women were of the Occident, while the head-gear just donned was that of their native land, to which they had been used from their youth, until laid aside, with their Oriental costumes, when they launched out to seek their fortune in a foreign land. They are extremely proud of returning clad in a foreign costume, but few, especially of the men, want to be seen by their countrymen wearing hats.

Some landed at Beirut, while the larger portion waited to disembark at Tripoli. Some had been very successful in their enterprises and were talking of soon going again to the land of their adoption; some had made the trip back to Syria with the sole object of getting married and returning to pursue their fortune-making, while a few had been

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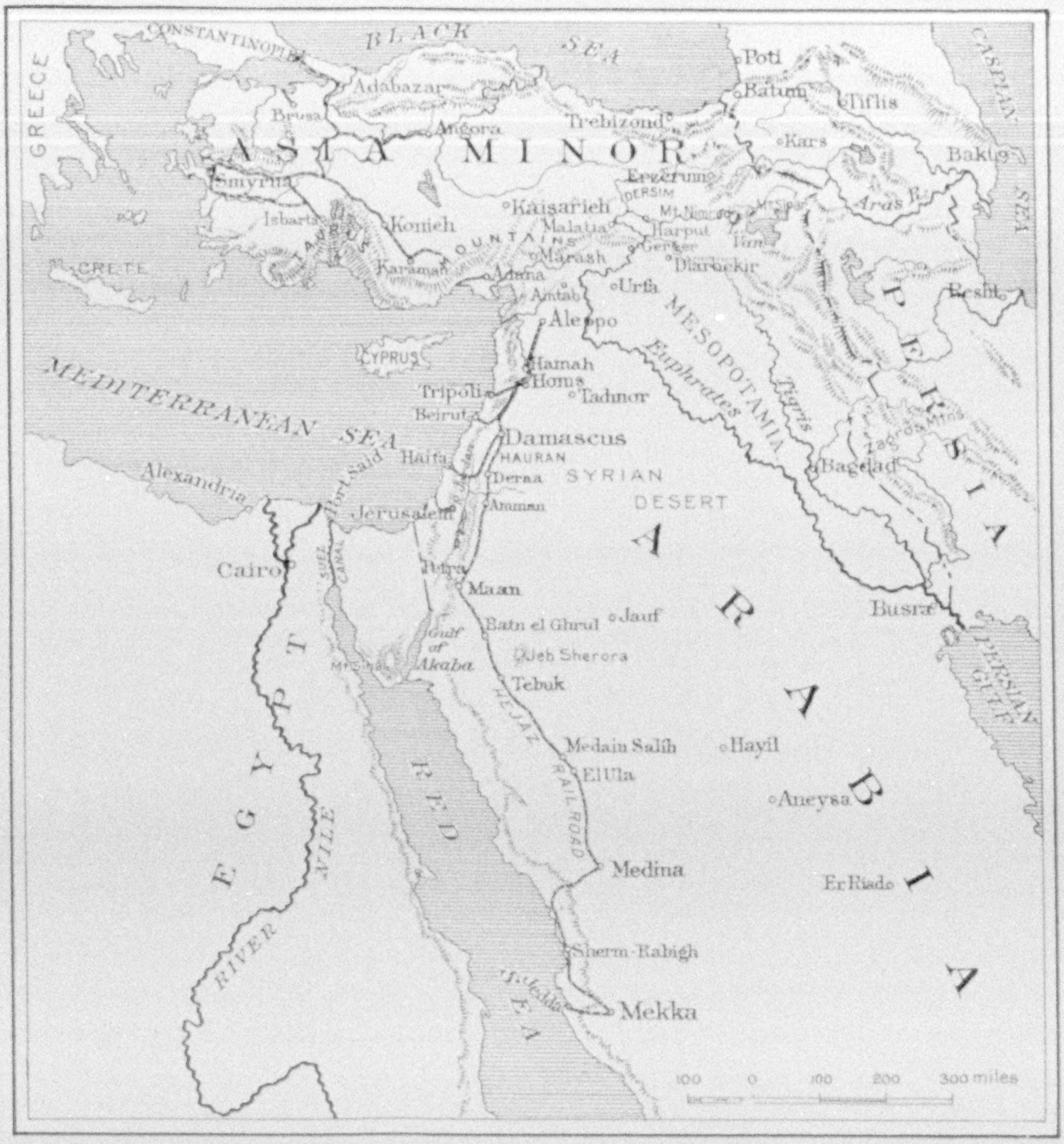
CONSTANTINOPLE
BLACK SEA
GREECE
Adabazar
Brusa
Angora
Trebizond
Poti
Batum
Tiflis
Kars
Baku
CASPIAN SEA
ASIA MINOR
Smyrna
Erzerum
DERSIM
Isbarta
TAURUS
Konieh
Kaisarieh
Malatia
Mt. Nimrud
Mt. Sipan
Aras R.
Harput
Van
Gerger
Karaman
MOUNTAINS
Marash
Diarbekir
CRETE
Adana
Aintab
Urfa
Resht
Aleppo
PERSIA
MESOPOTAMIA
CYPRUS
Hamah
Homs
Tripoli
Tadmor
Euphrates
Tigris
MEDITERRANEAN SEA
Beirut
Damascus
Zagros Mts.
HAURAN
Haifa
Port Said
Deraa
SYRIAN DESERT
Alexandria
Amman
Bagdad
Jerusalem
Cairo
SUEZ CANAL
Petra
Maan
ARABIA
Busra
Batn el Ghul
Jauf
PERSIAN GULF
EGYPT
Mt. Sinai
Gulf of Akaba
Jeb Sherora
Tebuk
HEJAZ RAILROAD
Medain Salih
Hayil
El Ula
RED SEA
Aneyza
NILE RIVER
Medina
Er Riad
Sherm Rabigh
Jeddah
Mekka
100 0 100 200 300 miles

MAP SHOWING PRINCIPAL TOWNS MENTIONED IN THE ARTICLE

entirely unsuccessful and were now planning to settle down to the simple life they had forsaken.

TRIPOLI IN SYRIA

While we were still quite a way out from the port of Tripoli a fleet of sailing boats glided swiftly out to meet us. The anchor dropped just as the sun set, and the cannon from the Crusader castle announced that the Mohammedan fast of the month of Ramadan had set in.[*]

Tripoli (to be distinguished from the African Tripoli), called in Arabic *Tarabulus,* is a twin city. The larger town is a little inland, nestled on the fertile plain amid a great area of orange and lemon groves, forming a sea of green, and on this account called by the natives "Little Damascus."[*] This town has grown so that its eastern edge has crept up the side of a low range of hills crowned by

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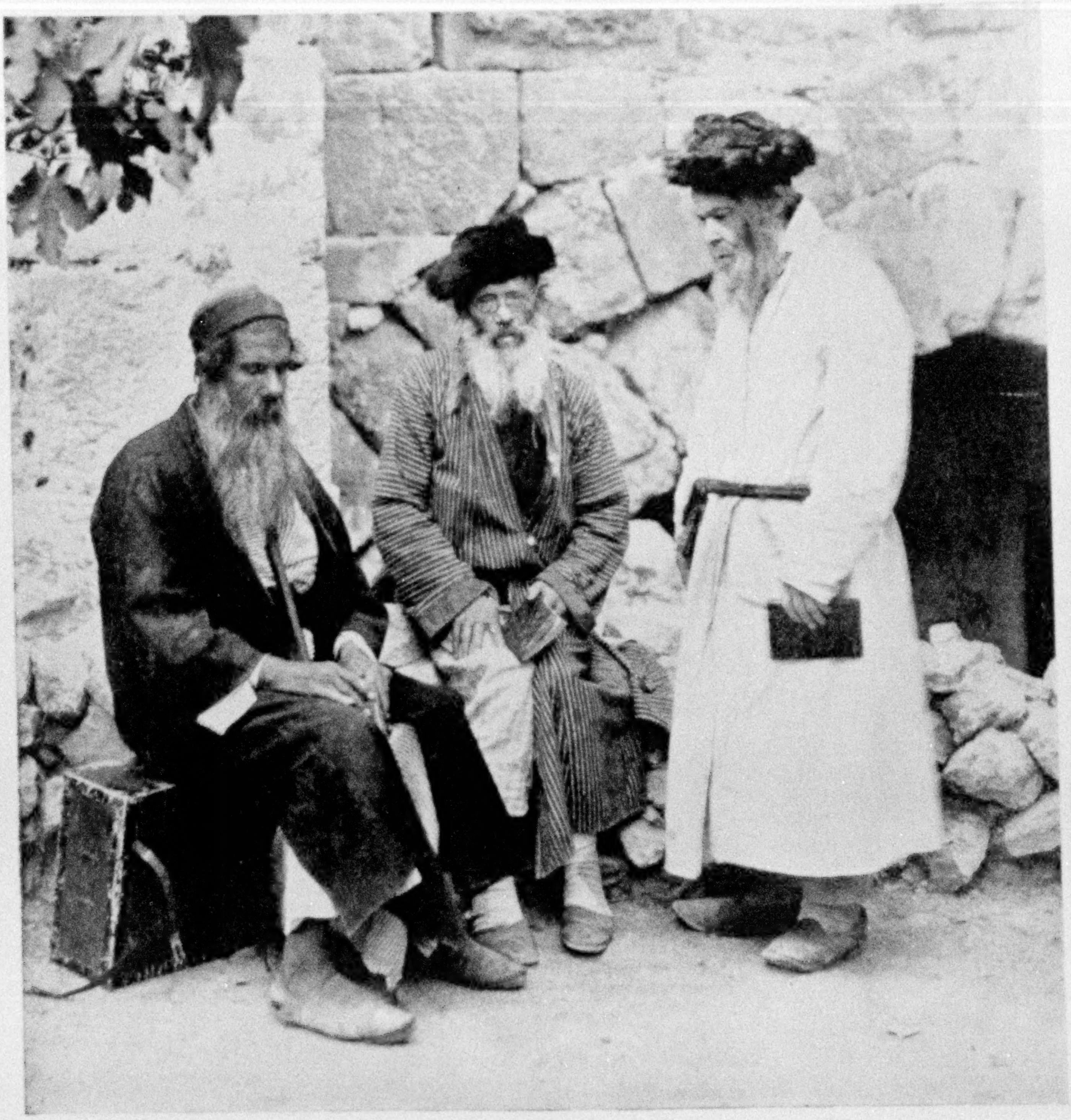
[*] The month of Ramadan is kept as a fast by all devout Mohammedans. During the entire day they abstain from food, drink, and even smoking, until sunset, when they may eat. Another meal is taken just before dawn. In the towns a cannon is fired twice—once to announce that the fast is over for the day and again as the fast rebegins.

[*] Damascus is noted for the verdant gardens which surround it.



RABBIS IN JERUSALEM

a large Crusader castle, which, at least outwardly, is well preserved and has long served as a barracks for Turkish troops.

THE CRUSADERS' INFLUENCE AT TRIPOLI

Tripoli, like most of the towns in this part of the country, has a varied history, having been first dominated by the Phœnicians, and then successively by the Seleucides, the Romans, the Moslems, the Crusaders, and now the Turks.

It was during the five-years' siege, begun by Count Raymond of St. Giles in A. D. 1104, that the Crusaders built the castle that overlooks the town to prevent any relief from coming from the outside. This fortress during our visit was evacuated by the Turkish troops and the ammunition removed to a safer place further inland, in view of the war with Italy. It is a rather elongated building, the walls facing the ravine being higher and better protected (see page 79). From a Crusader's point of view, the castle could not have been better placed, but with modern artillery it would be an inviting target to a man-of-war.

The smaller town, called El Mina (the port), is located on the bay about two miles from the larger town, the space

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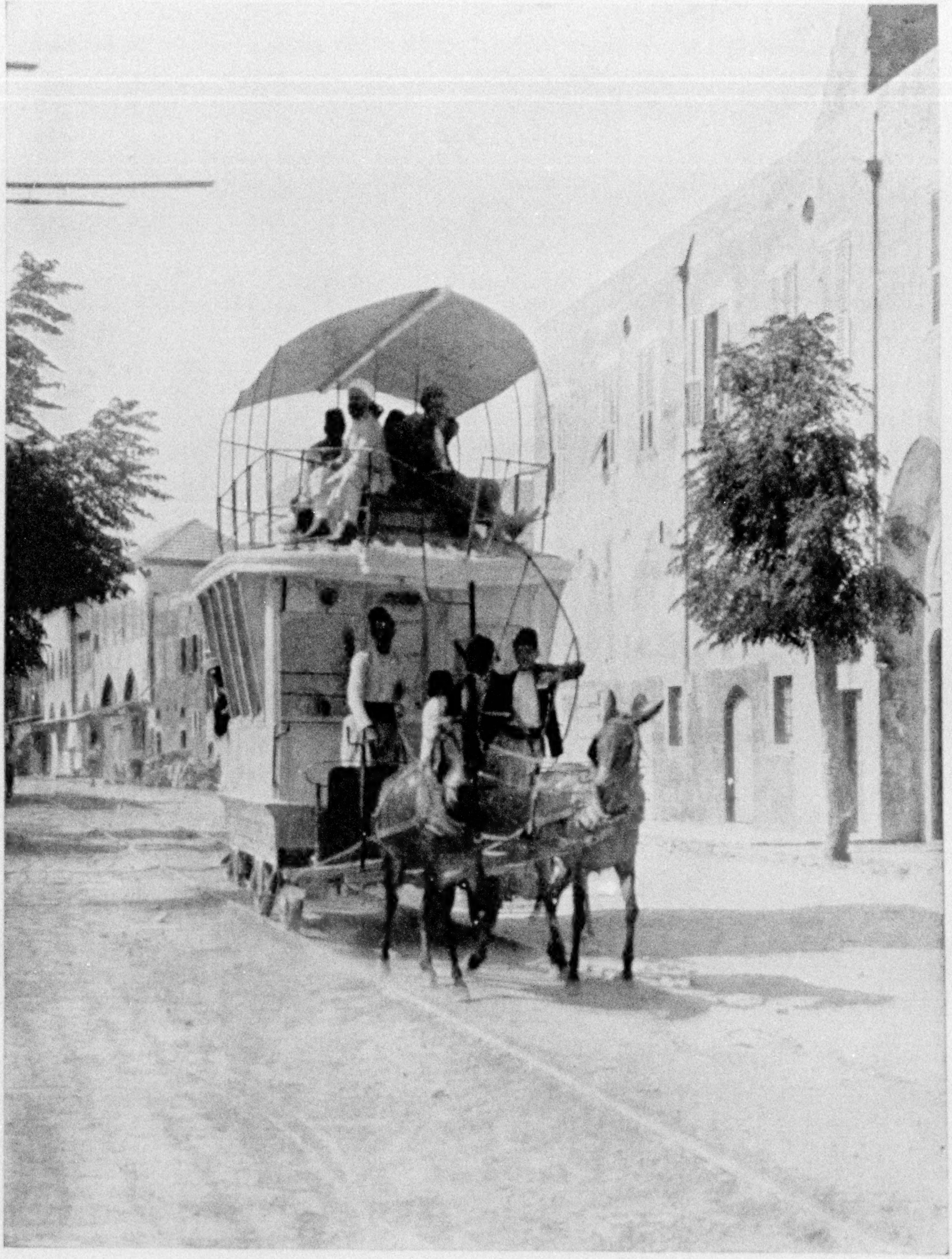


A MULE-DRAWN STREET CAR OF CURIOUS DESIGN RUNNING BETWEEN THE TWIN TOWNS OF TRIPOLI (SEE TEXT, PAGE 75)

The traveler from the West is usually surprised to find how often the electric street car of American manufacture is found running merrily in the most unexpected places all over the East. The above type of street car is one which is rapidly giving way to the more speedy and comfortable competitor from the West.

between being a green expanse of orange orchards and mulberry trees irrigated by the mountain streams. The two towns are connected by a primitive mule-drawn street-car service (see page 74).

RAILROAD EXPANSION IN SYRIA

About a year ago a railroad was constructed from Tripoli by a French company to connect with their lines running from Beirut and Damascus to Aleppo.

Since operations have begun on the Aleppo section of the German railway line from opposite Constantinople to Bagdad, Tripoli has become an active seaport for receiving rail and railway materials, which are sent over the French line to Aleppo, thence to be reshipped to the eastern end of the line, which during our visit was nearing the Euphrates.

On the coast near the railway station is an ancient fort, built in the middle ages and called by the Arabs Burj es Seba (Tower of the Lion). Our friend the station-master, who calls himself Monsieur Khies, informed us that it was built by Cœur de Lion, but the style of architecture is Arabic.

It was one of a series of six forts built to protect the coast, only one other of which still exists, and it is in poor condition. The last one destroyed was to make room for the railway station. A petition has been sent to Constantinople, and, if granted, will also seal the doom of Burj es Seba, which, though fully worth being preserved as a relic of antiquity, is thought to be an obstacle in the way of the "iron road," as the natives say (see page 80).

The old saying, "The never-changing East," should be modified to "The slowly changing East," at least as far as Palestine and Syria are concerned. One cannot travel through these countries without constantly being struck with the intermixture of the very old and the new side by side.

THE FAST OF RAMADAN

After two full days at Tripoli, we were ready to start for our first goal, the Cedars of Lebanon. We woke while it was still dark, thinking Mohammed Ali, our muleteer, had come with the horses, but instead found it to be a man with a drum, which is beaten with a strap to awaken the sleeping fast-keepers to their early morning meal. The pealing of a cannon at this hour serves for this purpose, but it is supplemented by a number of poor men, each one of whom voluntarily canvasses a given district with a view to receiving, on the feast at the end of Ramadan, presents of food and cash.

The night was still, and the voice and drumming recalled memories of childhood when living in the Mohammedan quarter of old Jerusalem. The crier stopped before each door, repeating short sentences, alternating them by a few flaps on his drum. His verse ran something like this: "Get up to your morning meal" (flap-flap-flap). "The Prophet has come to visit you" (flap-flap-flap). "Don't be lazy" (flap-flap-flap).

Mohammed Ali came in due time, and by the light of a small oil lamp in a smoked street lantern he loaded our heavy parcels on a mule, while the cameras were put on his mount in order to be more accessible en route. His small nephew, a boy of about 12, was taken along to drive the mule, which, however, he rode when the paths were not too steep. Mohammed Ali's horses could not be said to be fine mounts, but they were good enough, while he himself made up all deficiencies by his good qualities as a muleteer. Unlike most muleteers, he admitted his ignorance of the roads; but since one of us had been over this route once before, we were not anxious.

In ascending the Lebanon range through the valley before us to Bsherreh, where we were to spend the night, we followed the right-hand side of the Wadi Kadisha (Sacred Valley) along a carriage road, availing ourselves of short cuts now and then. The scenery was most striking. The entire hillsides were carefully terraced and planted with vines, from which hung large clusters of ripe fruit, unprotected except by a low stone wall.

"AMERICAN VILLAGES" IN THE LEBANON

We had just lost ourselves in the beauty of our surroundings when, looking up, we saw a native approaching us.

He was clad in a shirt and trousers of foreign make, supported by a broad patent-leather belt. However, he wore native slippers and head-gear and he swung a heavy club in his hand. He looked at us and the grapes inquiringly, but was soon reassured, and addressing us in Arabic, asked what we were doing here and where we were from.

We were also inquisitive to learn something of his history, and took him to be one of the many natives who had been seeking their fortune abroad. So in reply to his query we said, "From the United States."

This hit the nail on the head; his face beamed as he began in broken English, "You all from United States? I American. I real citizen. I just come back for small time. I watch all those vineyards. All those grapes mine. You go up to spring, rest little; me bring plenty grapes, countrymen. You from America. Dat's my country. This country no good. America good country."

As we ascended we were continually passing beautifully located villages, most of the houses being of a modern type, large and with bright red imported tiled roofs, while a few were of old style, with low, flat roofs, consisting generally of two or three rooms built in a row, with a porch of pointed arches running the full length and surrounded by gardens of mulberry trees, with the leaves of which they feed the silk-worms.

It was evident that here was a portion of the Lebanon from which the emigration had not only been large, but also successful. It showed also how the money gathered in America was brought back here to be enjoyed. The glowing accounts of business success brought back from America enkindle in the young people of this region the ambition to repeat the experiences of their elders.

To those who have seen the miserable surroundings of these Syrians in their colonies in, say, Chicago, where they are huddled together in crowded rooms in dilapidated houses, gathering their money by peddling for large profits and spending very little, their glowing stories of their success and importance when there does not greatly appeal.

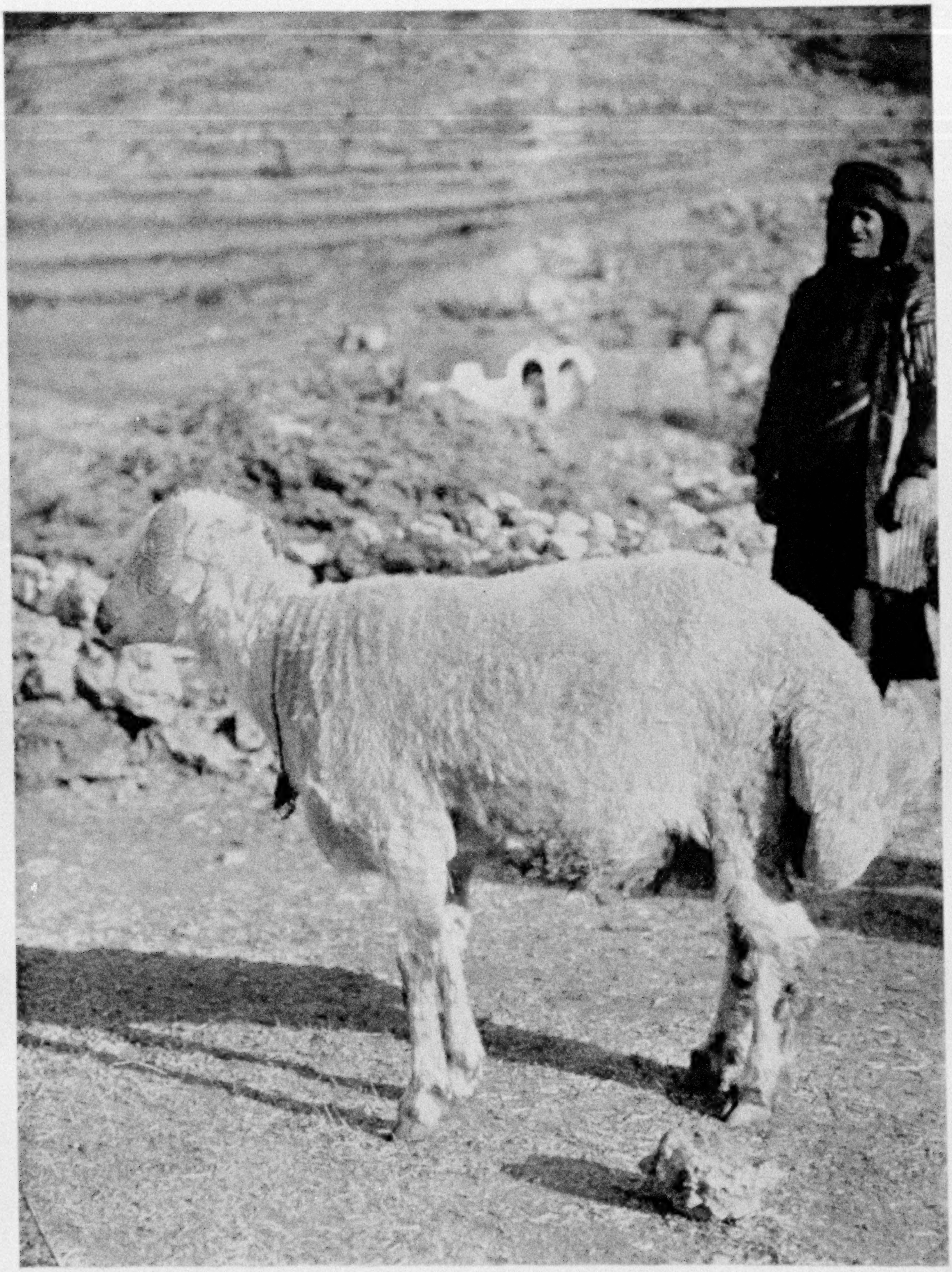
However, the natives look up to them as merchant princes, and their small fortunes avail here for much display. These "American villages" in the Lebanon, as they are sometimes called, are almost bewitching when viewed from a distance, but a nearer inspection brings disillusion. While the houses are comparatively clean, the streets are dirty and disorderly.

SOME "AMERICAN" GENTLEMEN

From Ain Sindiani the mountain slopes grew very steep and the carriage road winds up in short turns, so that short cuts are resorted to by pedestrians and animals. In crossing one of these we came upon a number of donkeys heavily laden with grapes. Their drivers were dressed in the ordinary costume of the Lebanon working class, and on their shoulders each carried a hard-wood pole about 8 feet long and 1½ inches thick, and which served the double purpose of urging on their patient beasts and of defense.

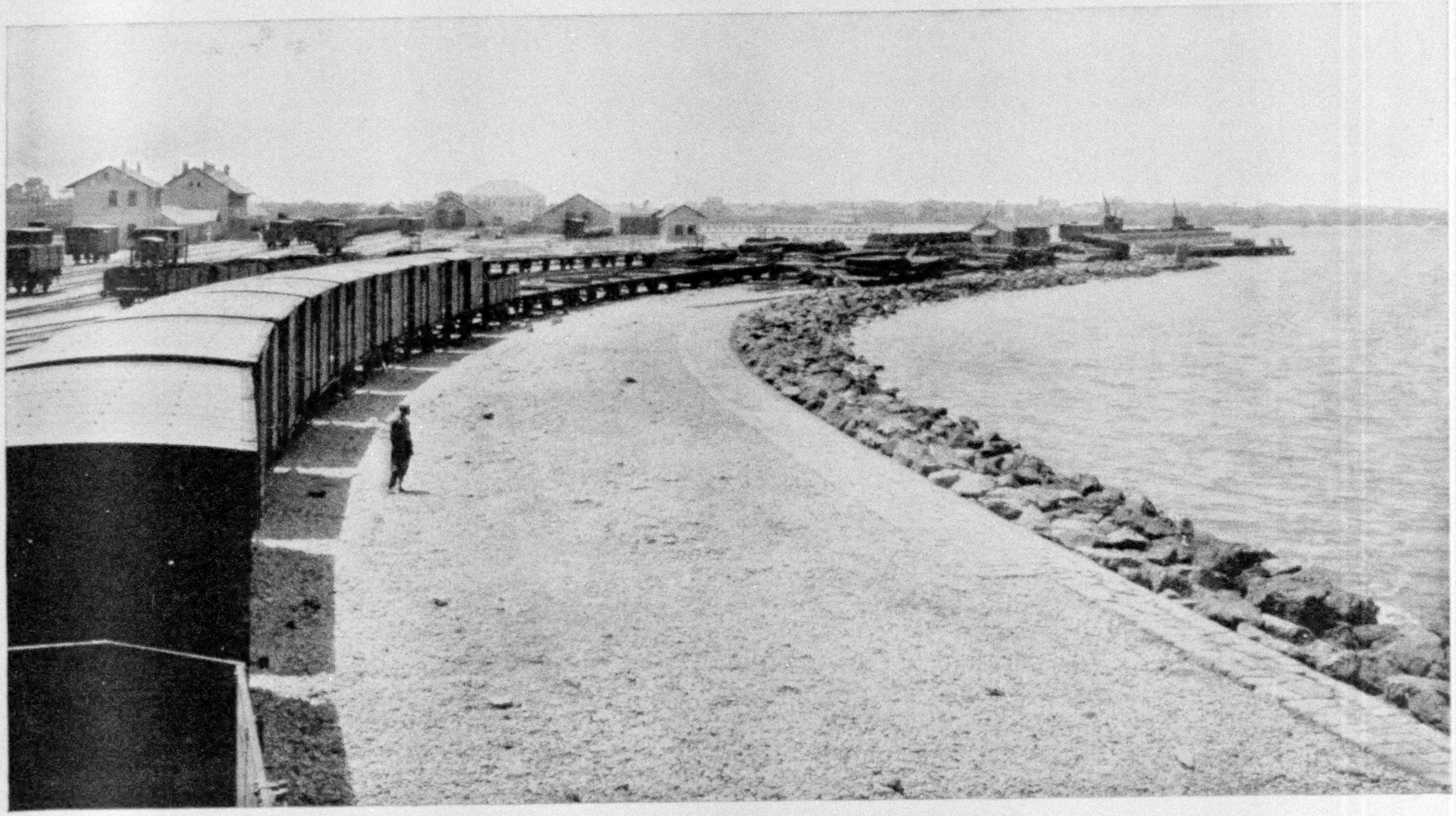
We saluted them in Arabic and found they were going over the pass above us to sell their grapes at Aineita. These in turn found out we were Americans, and one began, "I been all over America. I been to Michigan, Buffalo, and Detroit. That mighty good country. Where you from?" In reply, pointing to Mr. Baldwin, we said, "That gentleman comes from Philadelphia." "Oh!" he broke in, "you see those gentlemen," pointing to his fellow donkey drivers, clad in a sort of bloomer-like trousers reaching to about the knees, made of heavy blue cotton cloth, with tight-fitting vests, with long sleeves of the same material, over which they wore native coats of bright colors, "they come from Philadelphia. Thi country no good. Here walk everywhere. In America ride train, go everywhere. Donkey no good. I go back to America bye and bye. I got some properties here, for that I come back."

We outstepped the heavily laden asses and were soon out of speaking distance. We had now attained a considerable height when we noticed a number of fossils, one mass being as large as a half-bushel basket and composed of fos-



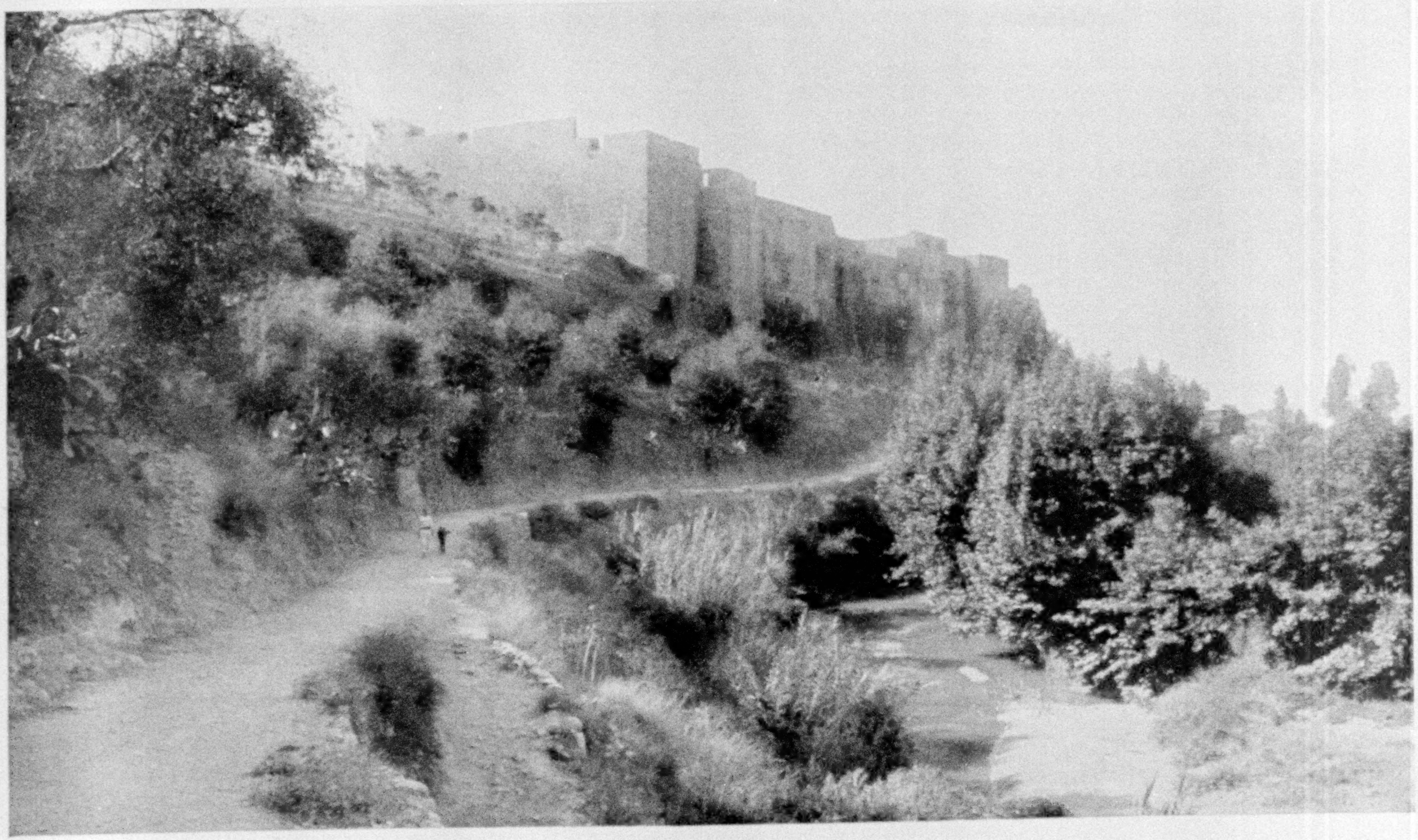
A FAT-TAILED SHEEP

These large-tailed sheep are seen throughout the Lebanon. The people fatten them excessively by forcing mulberry leaves and other food down their throats, so that their tails become of an enormous size. To such a size do they grow that they often become an impediment to the animal's movement. In these cases the natives build little wheeled trucks to which the tail is fastened, the sheep being thereby relieved of the weight, and freedom of movement is secured. Note the charm hung around its neck to ward off the evil eye.



THE FRENCH RAILROAD STATION YARDS AT EL MINA, WHICH, WHEN THE BAGDAD RAILROAD IS COMPLETED, WILL CONNECT TRIPOLI WITH CONSTANTINOPLE AND THE PERSIAN GULF AND WILL RENDER IT A PORT OF CONSIDERABLE IMPORTANCE

A great deal of the material used upon the construction of the new German railroad from Constantinople to Bagdad is now imported at Tripoli and carried by this French line to Aleppo



THE LARGE CRUSADER CASTLE AT TRIPOLI, ONE OF THE BEST PRESERVED BUILDINGS PUT UP DURING THE CRUSADER OCCUPATION OF THE HOLY LAND

"It is a rather elongated building, the walls facing the ravine being higher and better protected" (see text, page 73)

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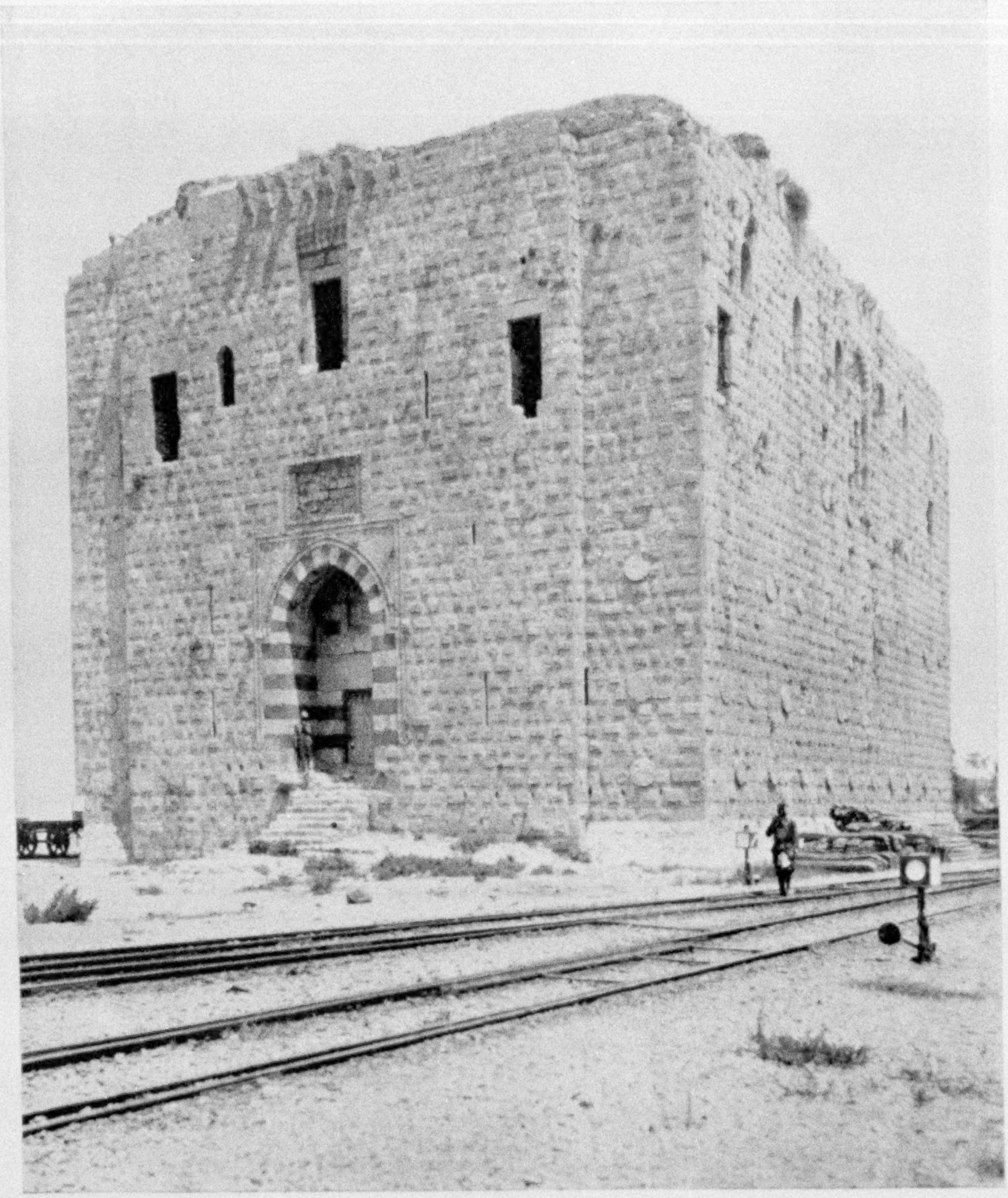

BURJ ES SEBA AT TRIPOLI, A RELIC OF ANTIQUITY DOOMED TO DESTRUCTION, TO MAKE WAY FOR THE "IRON ROAD" (SEE TEXT, PAGE 75)

This fort was probably built about the year 1000 A. D. by the garrison which owed allegiance to the Fatimite caliphs of Egypt, who treated the city with great favor and made it the headquarters of a trading fleet. Local tradition makes the builder Richard Cœur de Lion, but the Arabian style of architecture proves that it was not built by any of the Crusaders. Its Arabic name, Tower of the Lion, probably accounts for the tradition regarding Richard the Lion-hearted.

silized shellfish of many forms, proving that these regions were at one time below the sea-level.

We soon obtained our first view of the cedars beyond and above us, and passed through Hadeth and Hasrun and arrived at Bsherreh before sunset.

THE PROVINCE OF LEBANON

It will be recalled that the massacres of Christians in 1860 led to European intervention, since when the Lebanon has been an independent Sanjak or province, governed by a Mushir, who must be a Christian and is appointed for five years, with the consent of the Great Powers. There is no compulsory Turkish military service, and there is a small local force of paid soldiers who do police duty. Taxation is light. Under this administration excellent roads have been built throughout the province, by which nearly all villages are reached and benefited.

During the day the valleys were obscured by a haze caused by the heat of the day evaporating the moisture below, but in the cool of the evening, by twilight, climbing the mountains quite a distance above Bsherreh, a never-to-be-forgotten view was obtained. Here nature seemed to have carved out a huge amphitheater, terrace above terrace, the upper one being that whereon the majestic cedars stand, though not then visible from our point of view. Below, in the bottom of the valley, was a deep ravine, rock-bound by high precipitous cliffs of gray limestone, which contrasted strikingly with the green terraces of mulberry and vine that extended upward, one above the other, and which broadened in so doing. On our left the River Kadisha, which rises not far from the cedars, falls in foaming cascades down into the center of the amphitheater and loses itself in a silver line in the bottom of the gorge.

Bsherreh is on the edge of a great cliff almost at the head of the valley, but a little to the left, as one looks down toward the sea. Its water-supply is an ice-cold stream flowing down from the region of almost perpetual snow.

THE CEDARS OF LEBANON

We left Bsherreh at dawn and made our way up the steep and winding road towards the cedars. In some places it was difficult to pass the loaded animals coming or going. Having made all possible haste, we reached the cedars just as the sun was sifting its first rays through the thick foliage—a sight calculated to make any heart beat faster. The grove numbers about 400 trees. With the exception of a few stragglers, the grove is inclosed by a neat stone wall to protect the smaller trees from goats. In the center is a small Maronite chapel (see page 82).

To dwellers in Syria, where forests of tall trees do not exist, these majestic cedars must be overawing. A modern Syrian writer says of them, that they are "undeniably the most lofty of all the vegetable kingdom." The fact is that they are about 80 feet high, which is more than the height of the trees of an average American forest. They are justly renowned for the size of their trunks, the girth of the largest reaching 47 feet.

A striking peculiarity of these trees is the growth of their branches, which extend straight out at right angles to the trunk and are furnished with exceedingly thick foliage, brown as seen from beneath, but when viewed from the hillsides their upper surface resembles a rich, dark-green lawn studded with cones standing erect. These latter are the size of large goose eggs.

LEBANON NOW DENUDED

In some other parts of the Lebanon there are cedar groves, but the trees are much smaller. Here we have a suggestion of what the Lebanon was in ancient times, when the now bare peaks and mountain sides must have been covered with these trees.

It was here that King Solomon's seventy thousand hewers wrought, with their three thousand six hundred overseers, besides those supplied by Hiram, King of Tyre, to get the cedar wood required for the temple at Jerusalem, and which was taken in rafts to Jaffa and thence carried up to Jerusalem. These trees were also used in the construction of David's house, and later in the building of the second temple. A white resin which they

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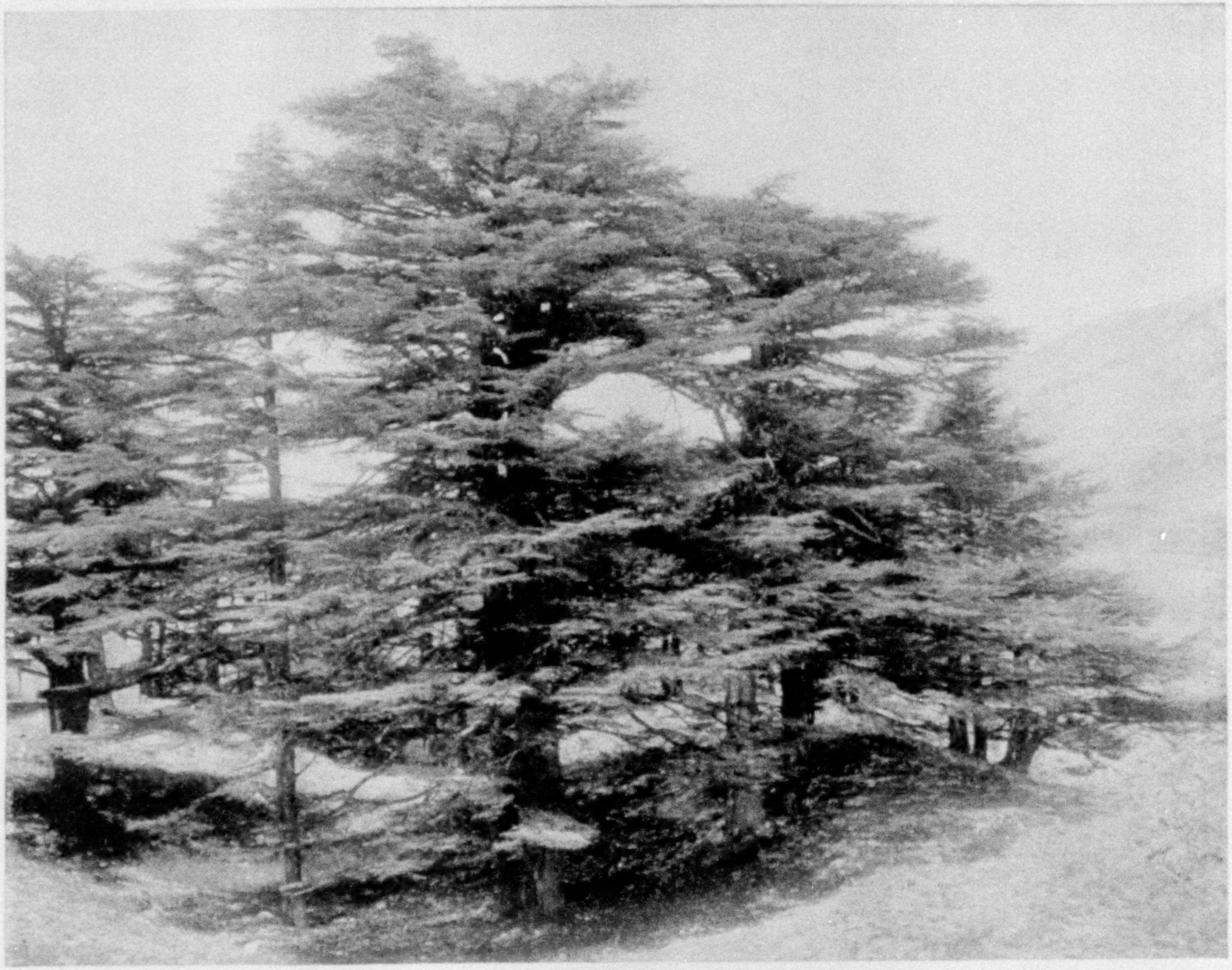

IN THE CEDAR GROVE, SHOWING THE MARONITE CHAPEL ON THE EXTREME LEFT (SEE TEXT, PAGE 81) exude served in the ancient process of embalming.

These trees (*Cedrus libani*), called by the natives "Arz," are a local variety of a widely distributed species. The wood is cream color and works up easily, much resembling soft pine. This grove stands on a small hill situated at 6,315 feet above sea-level, and above it rises abruptly the lofty Jebal el Arz, whose summit is seldom without snow.

The Christian natives attach a sanctity to these trees, and here is held an annual feast, to which pilgrims flock from all directions. It also serves as a delightful summer camping place. At the time of our visit a number of families were encamped among the trees, including some of the professors from the American College at Beirut, who, with their families, were here for their summer vacation.

WHEN DID SOLOMON LIVE?

While sauntering through the grove we encountered the Maronite priest in charge of the chapel. He asked how we liked the cedars, and in reply we expressed our admiration, but said it was a pity there were so few left. He replied, "So they have been for 4,000 years, and history tells us that they have been just as you see them since the flood." "But," we remonstrated, "Solomon got all his timber for the building of his temple from these mountains, so there must have been many more." "It is true," he said, "that Solomon got his timber here, but that was long before what I have just mentioned." A peasant standing by, regarding with awe the wisdom of the priest, added, "You see, khawaja (gentleman), these trees," pointing to some of the smallest of the cedars, "have been growing since the days of Christ."

As we turned away we mused upon this new leaf of history, that Solomon lived before the flood, and that it takes 2,000 years for a cedar to attain a diameter of about 18 inches.

Shortly after noon we reluctantly left the cedars, as between us and Baalbek there lay 10 hours on horseback, and we wished to deviate a little from the direct road, so we pushed on so as to shorten the next day's work.

Soon we came to the very steep ascent of Jebal el Arz (Cedar Mountain), which brings one to the top of the pass 7,700 feet above sea-level, while to the north towers a higher peak, Dahr el Kodib, 10,050 feet.

Both sides of this pass were covered with a thick layer of finely crushed stone, as if a gigantic stone-crushing machine had been at work for ages. The upper part of the ascent had to be done on foot, as well as all of the descent, for the horses' feet buried themselves in this loose mass, which kept slipping from under them at every step. This road has been described as akin to those encountered in Alpine climbing.

ON THE ROAD TO BAALBEK

The view from the top was superb. Far below, to the east, lay Baalbek and the great plain on which it stands, like a raised map, terminated by the Anti-Lebanon and the snow-capped peak of Hermon. To the east, far down through the beautiful valley we had traversed, Tripoli and its bay were plainly seen, and all bathed in shades of transparent blue.

Descending to Aineita, we spent the night in the priest's house. It is a small, poor village, lying just on the upper edge of the timber-line. The houses, all but the little church and a couple of others, are built of small stones without mortar, with low ceilings and with roofs of rough timber covered over with clay to shed the rain.

The house of the priest, which might be taken as a typical one, consisted of three rooms, two on one side and one on the other, connected by a roofed court. Native mattresses were spread for us on the floor and native quilts of exceptional thickness and weight served as covers. Everything was remarkably clean, and the night we had been dreading was passed comfortably.

THE LAKE OF VENUS

By dawn we were en route for the village of Yammouneh and the mountain lake of the same name. The latter in winter is large, but by the end of summer has dried up, even though it is fed

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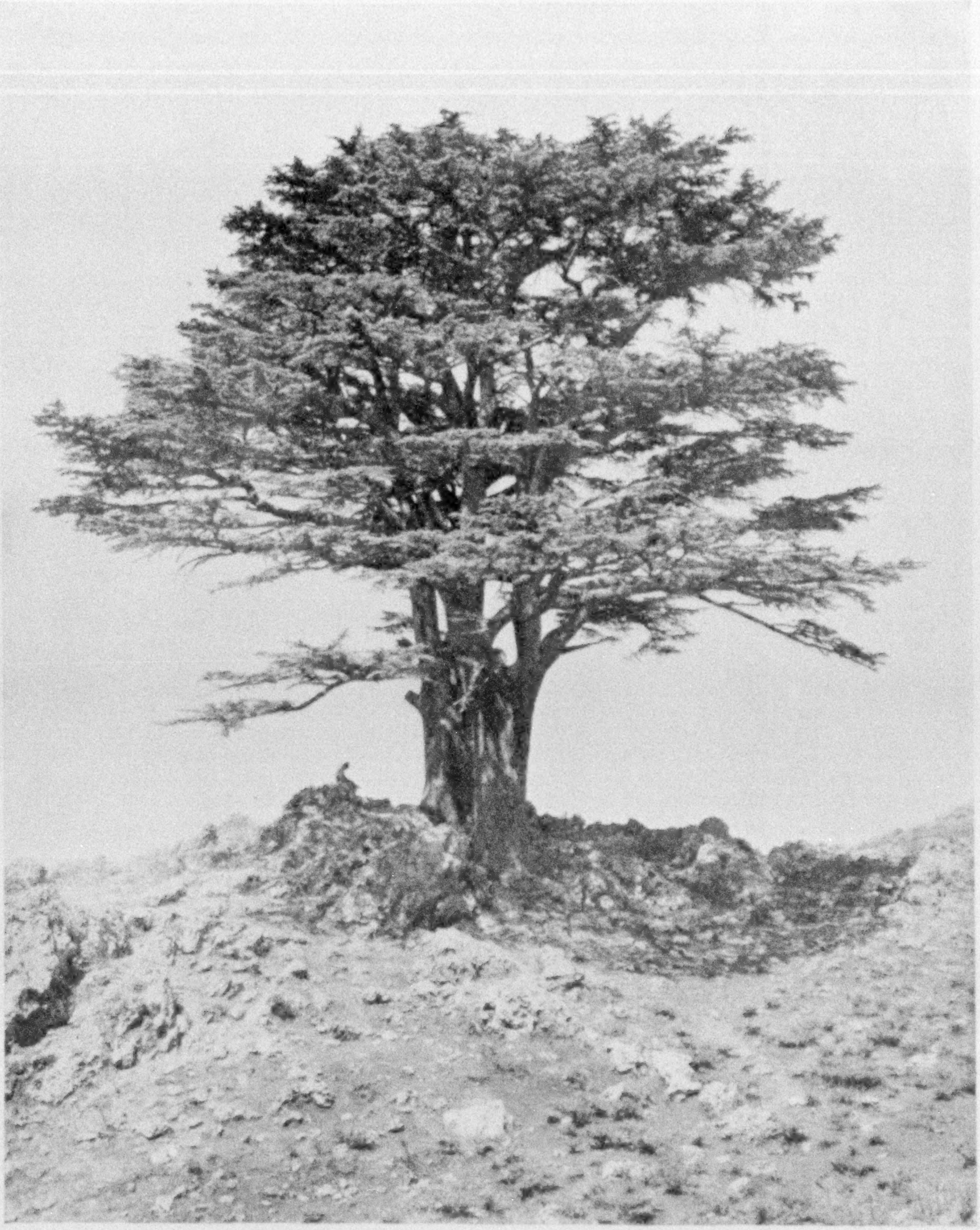
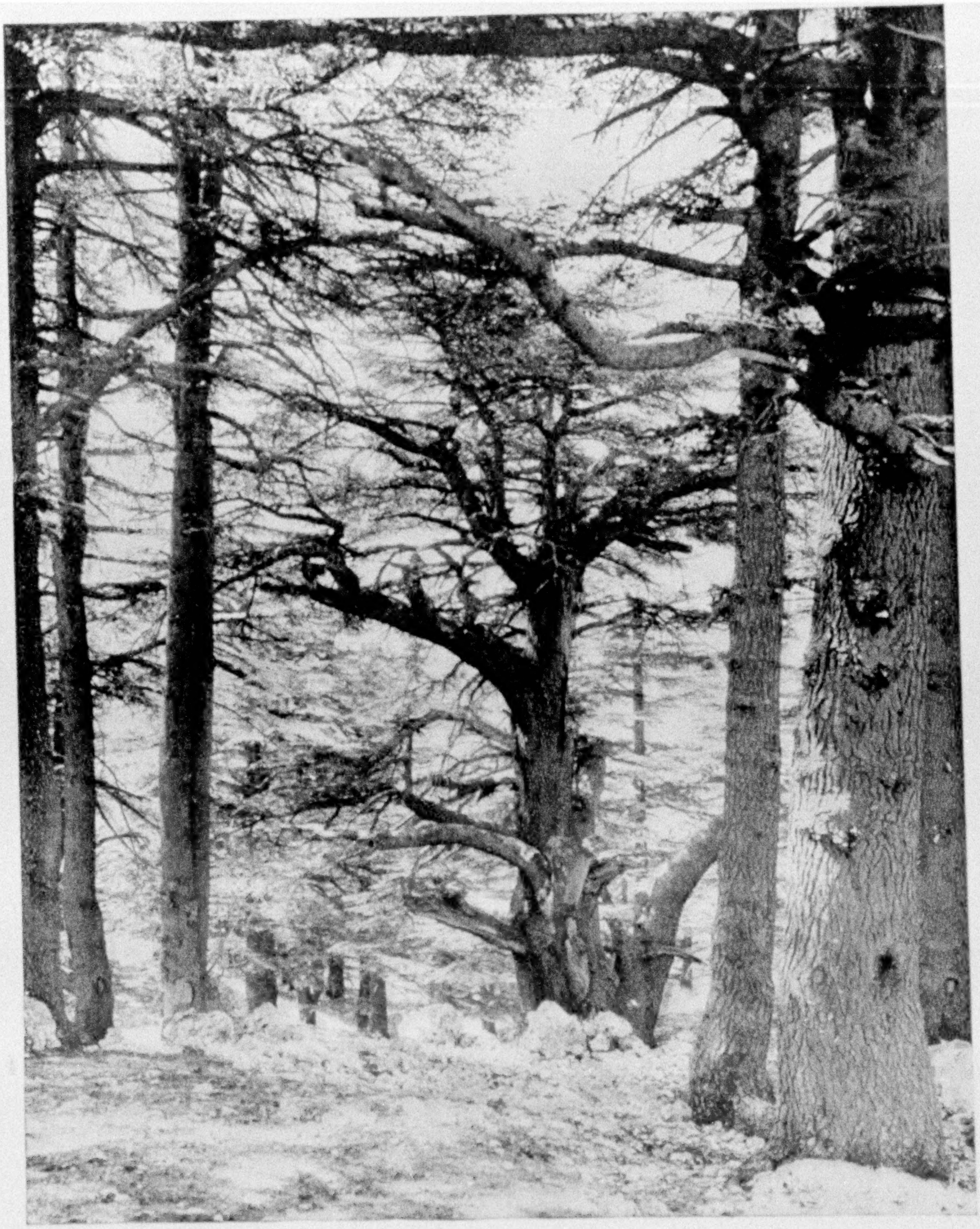


A TYPICAL CEDAR OF LEBANON, AS USED BY SOLOMON IN BUILDING THE TEMPLE

"And Solomon sent to Hiram, saying, . . . Now therefore command thou that they hew me cedar trees out of Lebanon; . . . for thou knowest that there is not among us any that can skill to hew timber like unto the Sidonians. . . . And Hiram sent to Solomon, saying, . . . I will do all thy desire concerning timber of cedar, . . . My servants shall bring them down from Lebanon unto the sea: and I will convey them by sea in floats unto the place that thou shall appoint me, . . . So Hiram gave Solomon cedar trees and fir trees according to all his desire" (1 Kings 5:2-10).



IN THE HEART OF THE CEDAR GROVE, SHOWING THE CONTRAST BETWEEN THE OLD AND YOUNGER TREES

The big tree in the center, while not the largest, is one of the oldest. These trees were much admired by the Crusaders, who attempted to introduce them into Europe. Some of these efforts were successful, and at Warwick Castle, in England, there are still some famous old cedars planted by one of the crusading earls of Warwick nearly 800 years ago.

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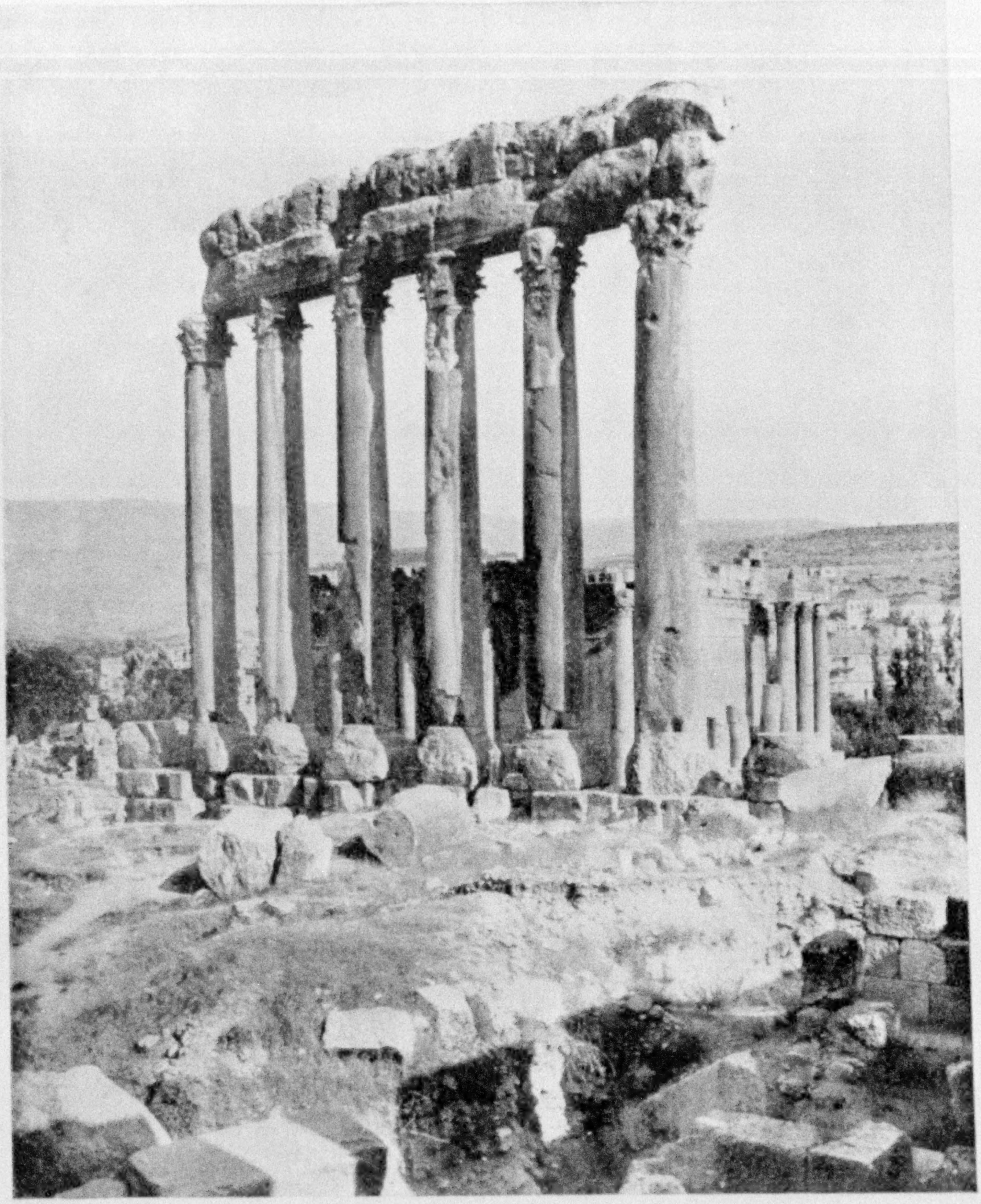
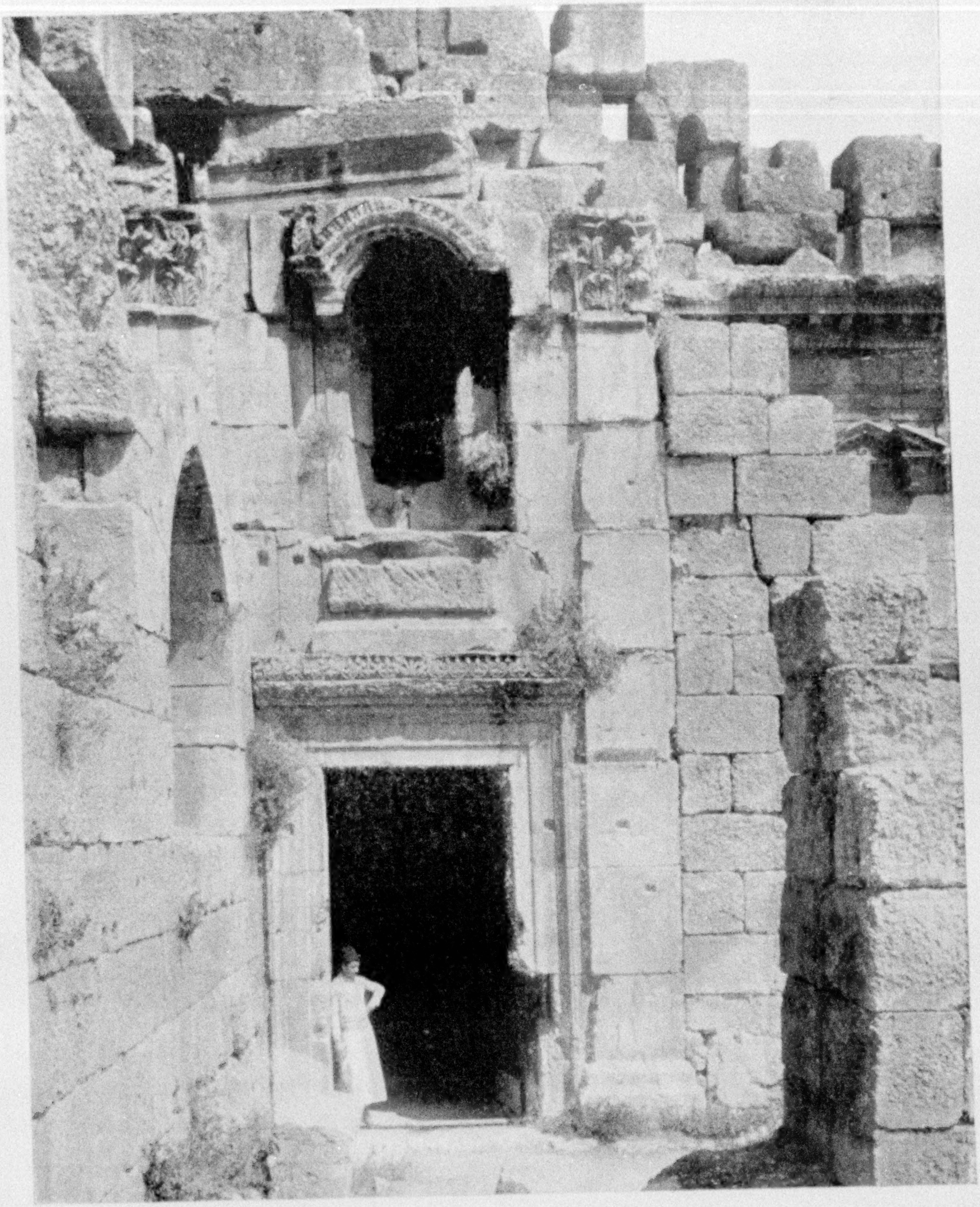


THE SIX PILLARS THAT REMAIN OF THE GREAT TEMPLE

"These lofty pillars do not taper as they appear to do when seen from below." Behind the pillars is seen the Temple of Bacchus. The Great Temple was dedicated to Jupiter, identified with Baal and the Sun, and with him were associated both Venus and Mercury, under whose triple protection the ancient city of Heliopolis was placed. The extreme license which marked the worship in this temple is often referred to by early Christian writers (see text, page 99).



ONE OF THE DOORWAYS LEADING FROM THE GREAT COURT INTO A SMALL ROOM WHICH MAY HAVE BEEN FOR THE USE OF THE PRIESTS: BAALBEK

The ruins at Baalbek were first visited in modern times in 1507, by a German, Martin von Baumgarten, and again, in 1555, by a Frenchman, Pierre Belon, who wrote two books upon the subject. Much damage was caused by an earthquake in 1759, the disorder then occasioned remaining till 1901, when the German Archeological Institute intrusted the work of clearing and excavating to an expedition headed by Professor Puchstein, under whom admirable work has been done.

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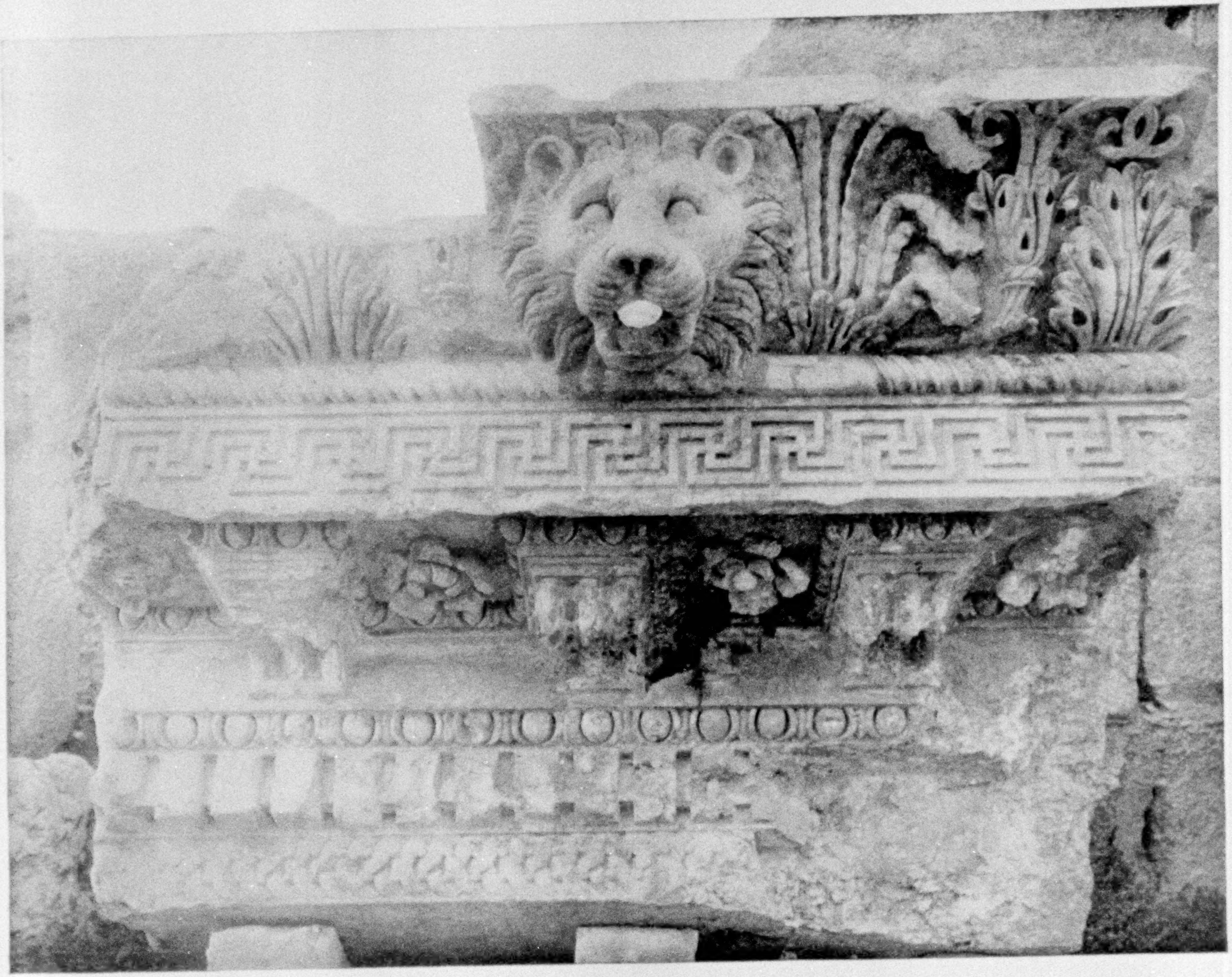

A SECTION OF THE FALLEN CORNICE OF THE GREAT TEMPLE: BAALBEK

A tall man standing on a level with the bottom of this fragment barely reaches the lion's mouth. In all, the entablature is 17 feet in height (see text, page 99) constantly by numerous springs around its shores. There is no visible outlet.

The natives account for this in various ways. Some of them say that the water finds its way by a subterranean passage to the other side of the mountain range, where it flows out, forming the spring called Afka. They base this theory on the fact that the fountain increases its flow and also diminishes and ceases its flow simultaneously with the lake.

On the shore of the lake is a ruin, consisting of large blocks of drafted stones, which is said to be the remains of a temple of Venus. Local mythology claims this as the lake in which Venus, when pursued by Typhon, changed herself into a fish.[*]

Shortly after leaving Aineita until we struck the Plain el Bika (the ancient name being Cœlesyria), the broad valley between the Lebanon and Anti-Lebanon, these mountain slopes were covered with forests of wild oak, juniper, almonds, and pears. The latter were full of fruit, and a proportionate number of small stones lodged among the twigs, thrown up by youngsters in their attempts to bring down the fruit.

The forests are now denuded of about all their tall, straight trees, and those now left are short and gnarled. Seen from a distance, this low range looks black in comparison with the higher ridge, which is bare of trees and therefore called in Arabic Ras el Akrah (the Bald Head).

THE WONDERFUL RUINS OF BAALBEK

From these forests to Baalbek on the other or eastern side of the plain there was little of interest, except large herds of camels and their young, until we came to the column of Yaat, which is an isolated shaft 65 feet in height, composed of 16 drums of limestone crowned with a Corinthian capital. Traces of an inscription can be seen near the base, which, however, does not disclose its secret, and one can only guess why and by whom it was built.

A half hour's ride to the southwest brings us to the world-renowned ruins of Baalbek, an adequate description of which would fill a volume.

These ruins, properly speaking, are known as El Kalla (Citadel) and are composed of only two temples, and they do not cover a large area when compared with other ruins in Syria. They are, however, unique in their massiveness and in the great amount of both bold and delicate carving with which they are adorned, of which there is so much and in such variety as to make one's first visit quite bewildering.

Since these temples were built on a flat plain, it was important to raise them above the surrounding level to render them more imposing, and to that end there are vast substructures of vaults and passages supporting these shrines.

THE GREAT TEMPLE

The Great Temple, or the Temple of Jupiter, as it is called, had its main entrance from the east. Here a wide flight of steps led up to the propylæa, 19 feet above the gardens and orchards that now surround the ruins. This portico was open to the east the full width of the stairs, and the worshipers used to enter between rows of columns, on the bases of three of which are inscriptions stating that the temple was erected to the "great gods" of Heliopolis by Antoninus and Caracalla. At an early period the Arabs converted these temples into a fortress, and to a certain extent remodeled them. The columns mentioned were removed, the staircase taken up, and the material used to construct a solid wall where the columns had been.

Next came the hexagonal forecourt, entrance into which was made by means of a central doorway, with a smaller one on each side. This small court was surrounded by a colonnade, and on four of the six sides by exedræ. The Arabs have also blocked this three-fold entrance and converted the exedræ into fortifications, filling them with brick masonry.

WORK OF THE GERMAN ARCHEOLOGISTS

Since the visit of Emperor William to these ruins, in 1898, a body of German excavators were sent to Baalbek, who worked here from 1901 to 1904, and

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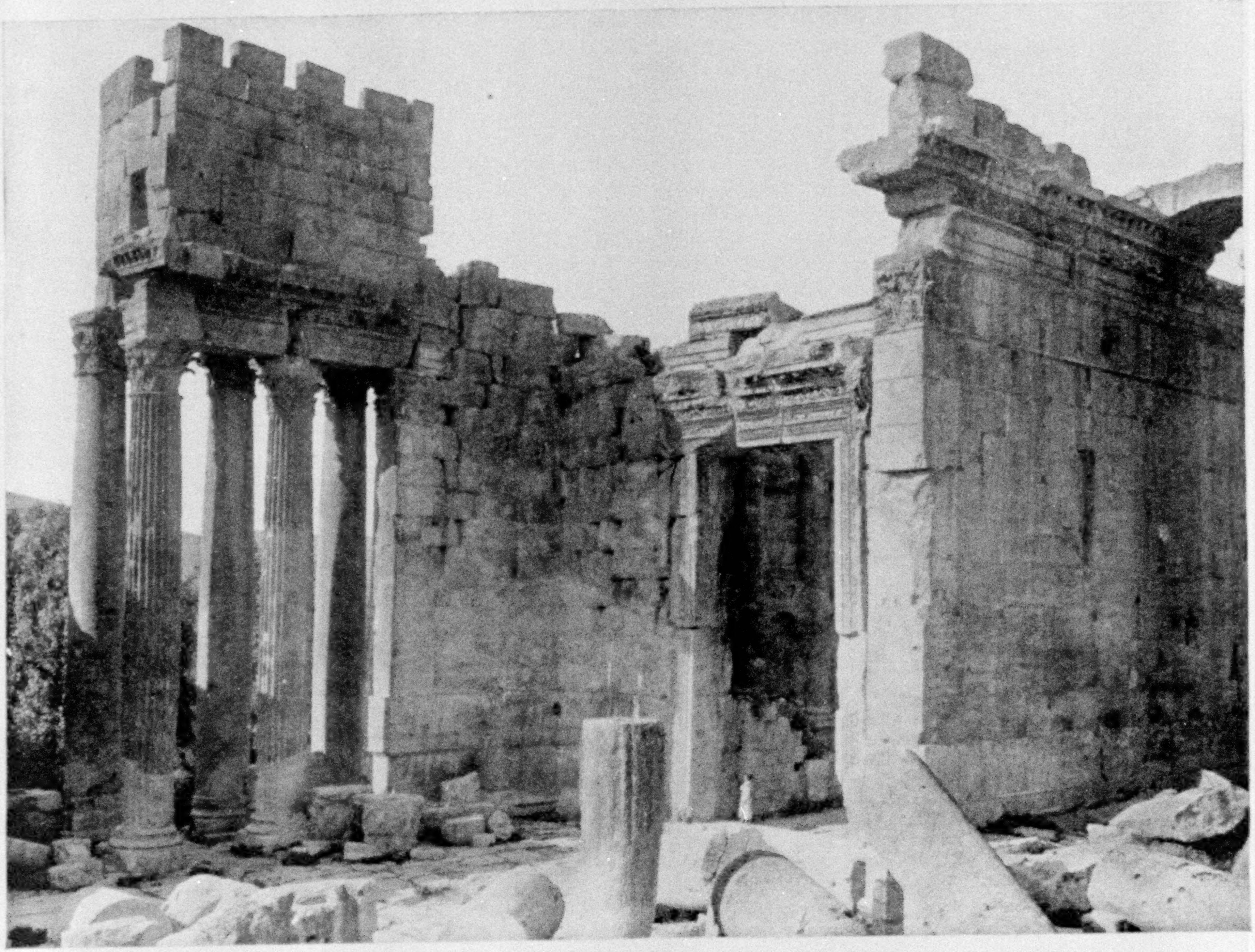
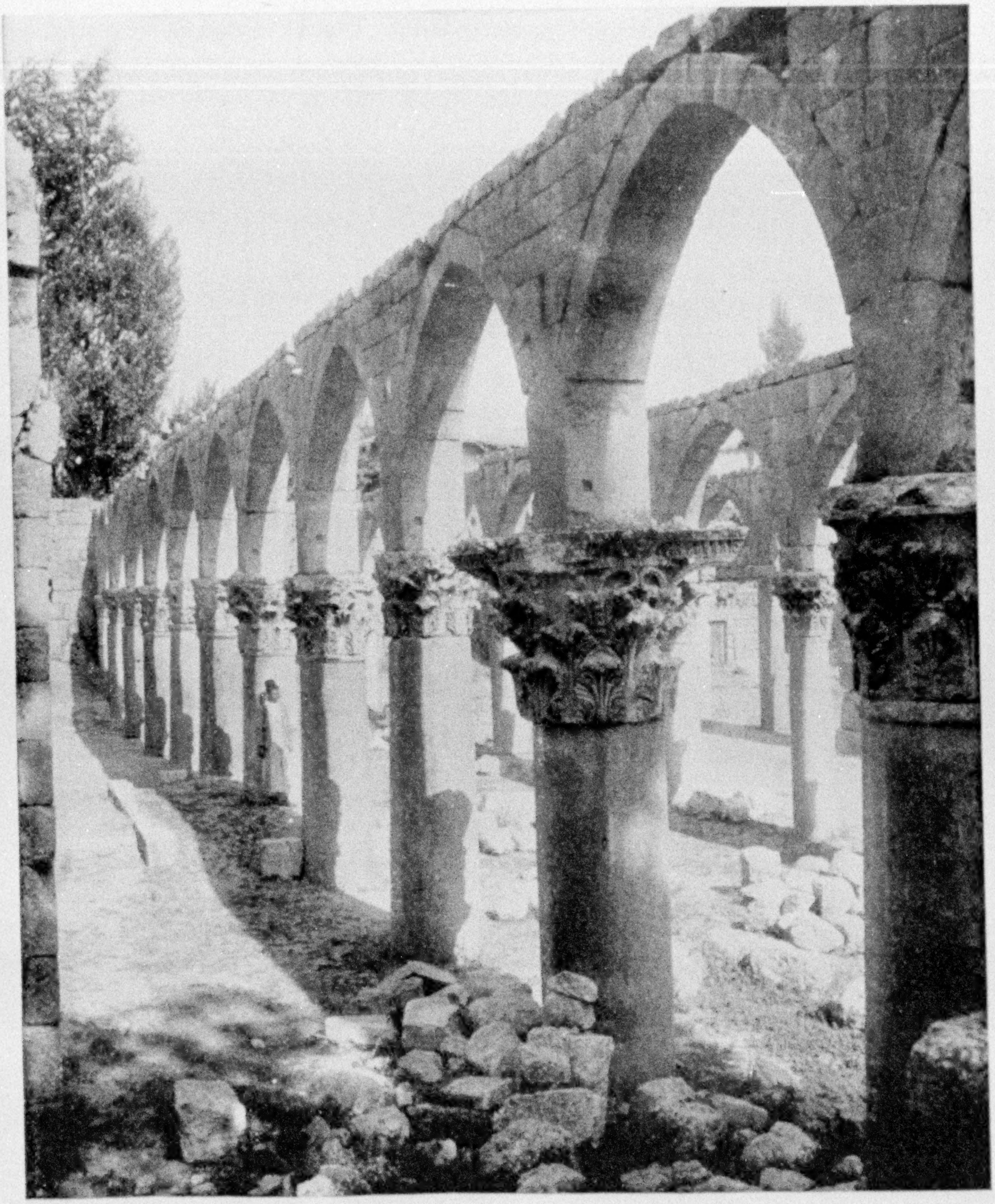
[*] History of Baalbek. Michael M. Alouf.



VIEW OF THE FRONT END OF THE TEMPLE OF BACCHUS. NOTE THE ARABIC FORTIFICATION BUILT ABOVE THIS TEMPLE SOME IDEA OF THE SIZE OF THE GREAT PORTAL CAN BE OBTAINED FROM THE FIGURE STANDING BENEATH IT



RUINS OF ONE OF THE MOSQUES AT BAALBEK, BUILT OF ANCIENT MATERIALS FROM THE TEMPLES

Although the population of Baalbek now numbers only about 5,000, it was in the middle ages a flourishing and well fortified Moslem city, which was visited and described by the Arab geographer Abulfeda, Prince of Hama (see page 109). The mosque shown above probably dates from the reign of Sultan Kalaun (1282). So well fortified was Baalbek that, while the Crusaders raided the valley several times, they never succeeded in taking the city.

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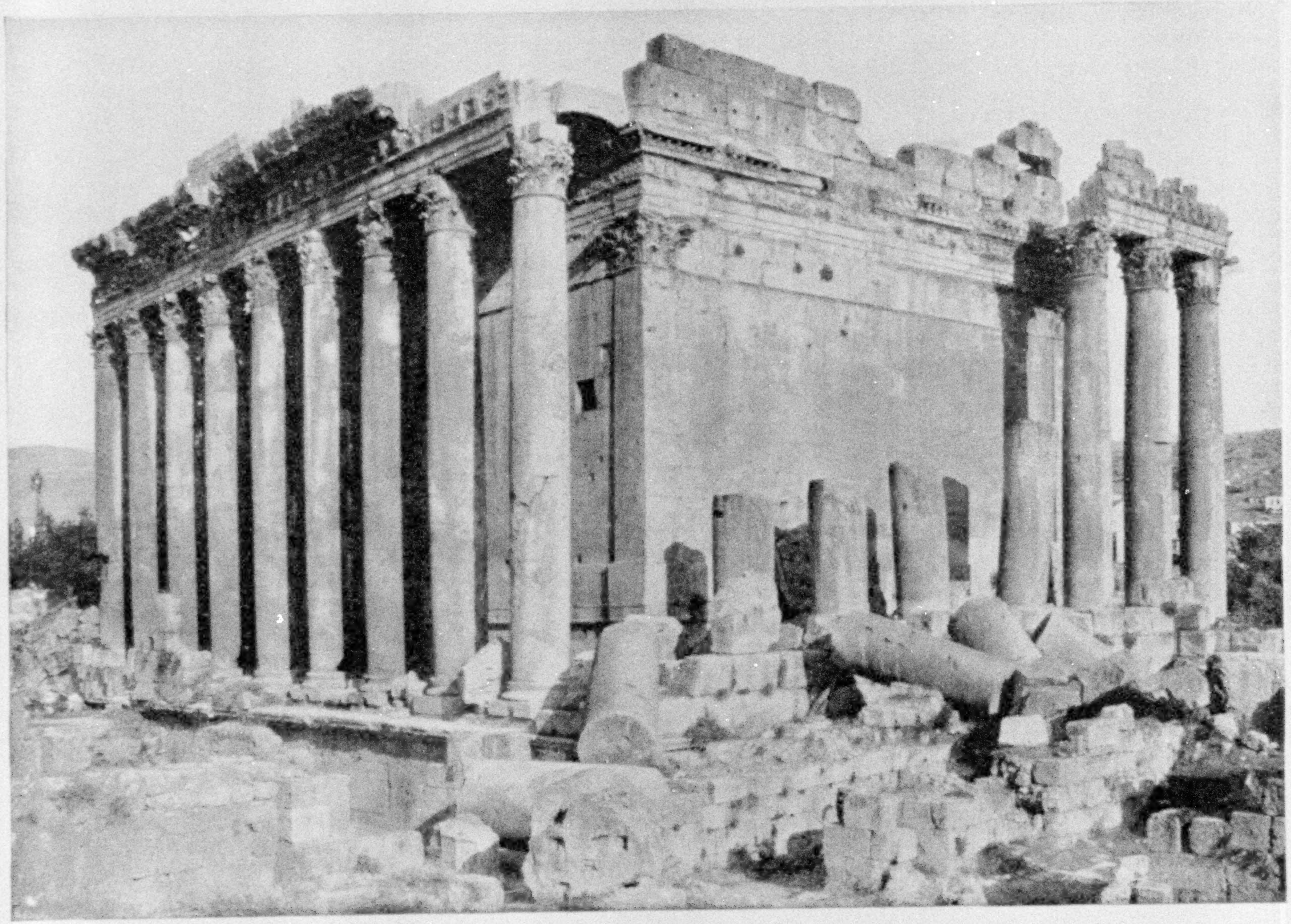
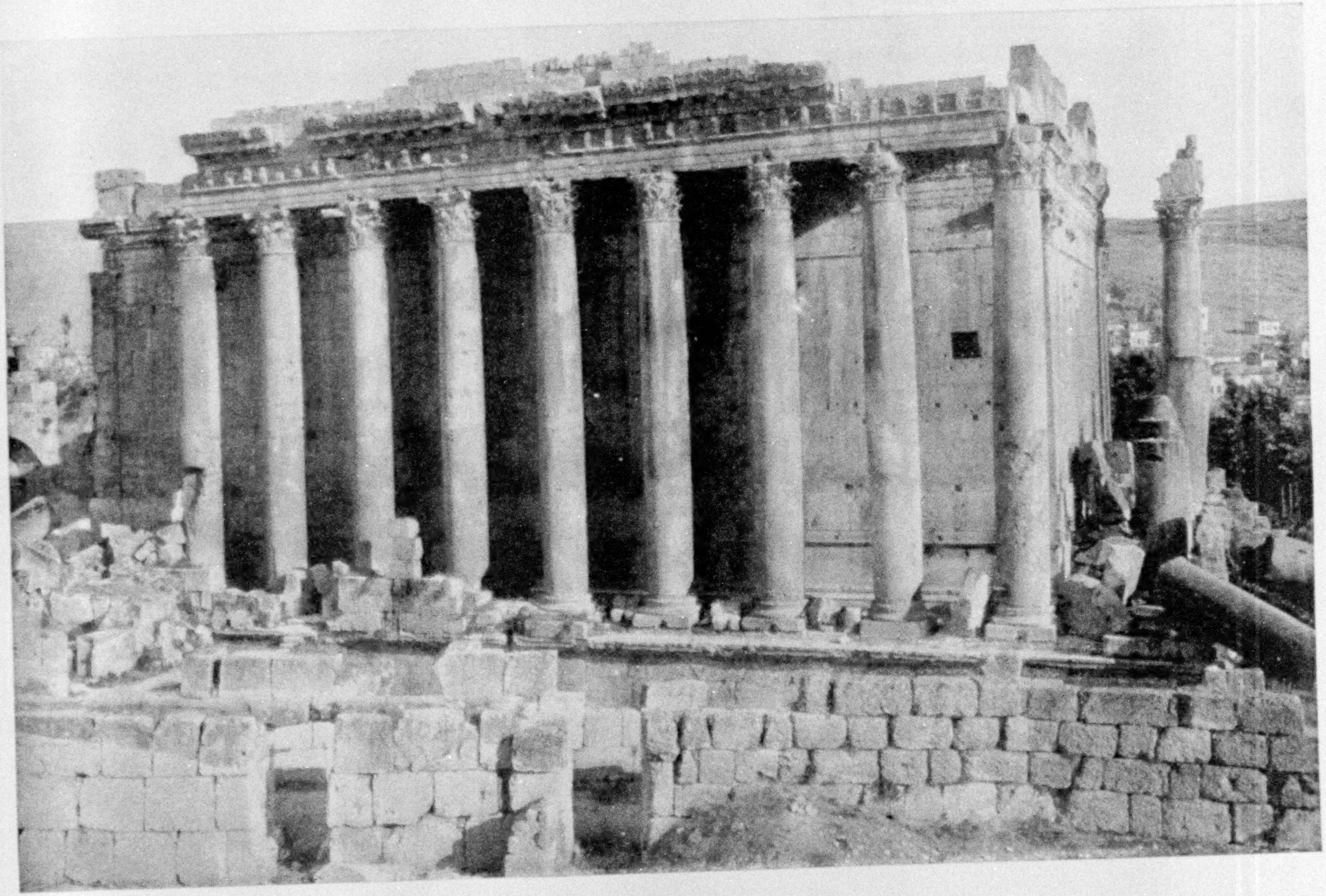
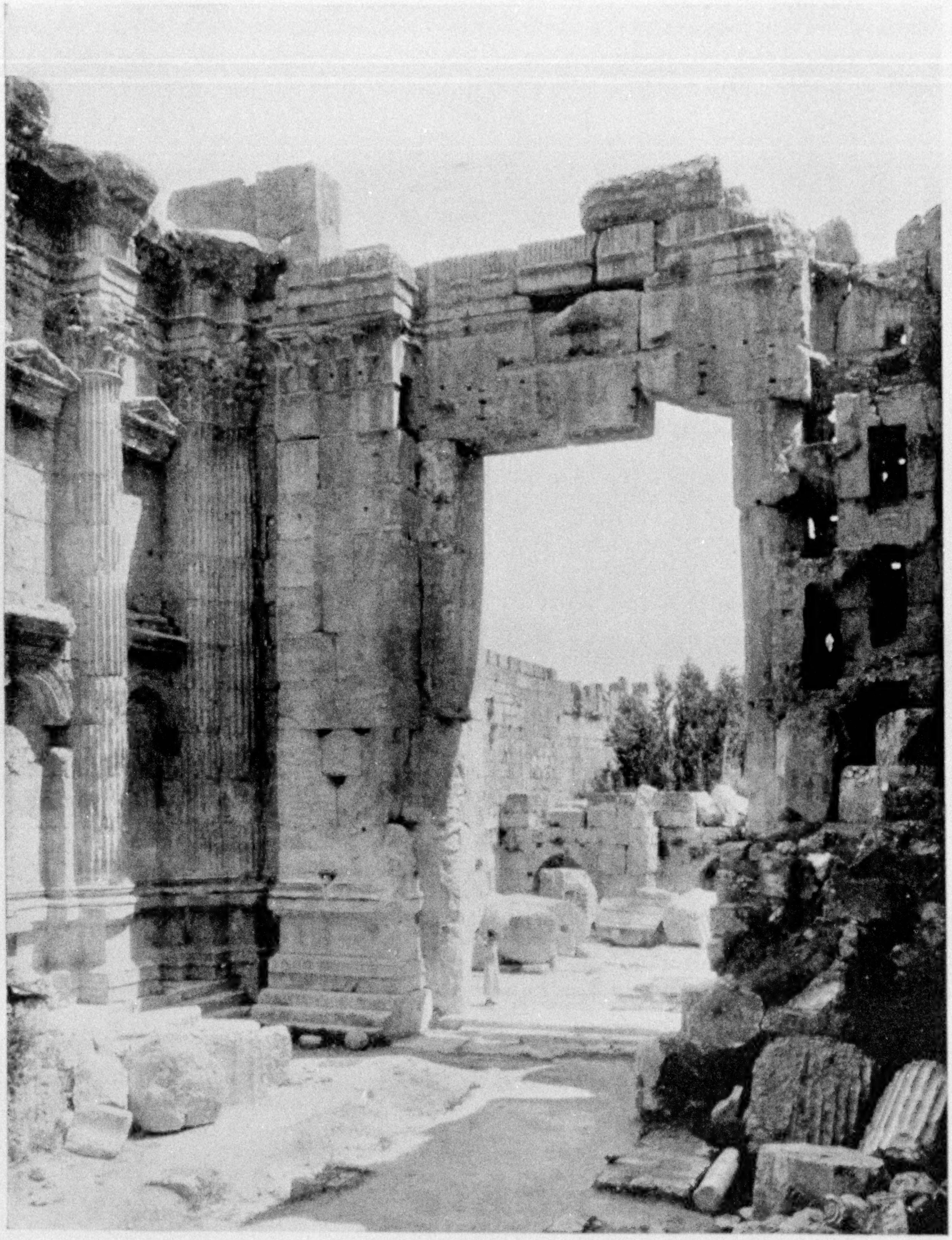


TEMPLE OF BACCHUS: VIEW FROM THE DIRECTION OF THE GREAT TEMPLE (SEE TEXT, PAGE 99)



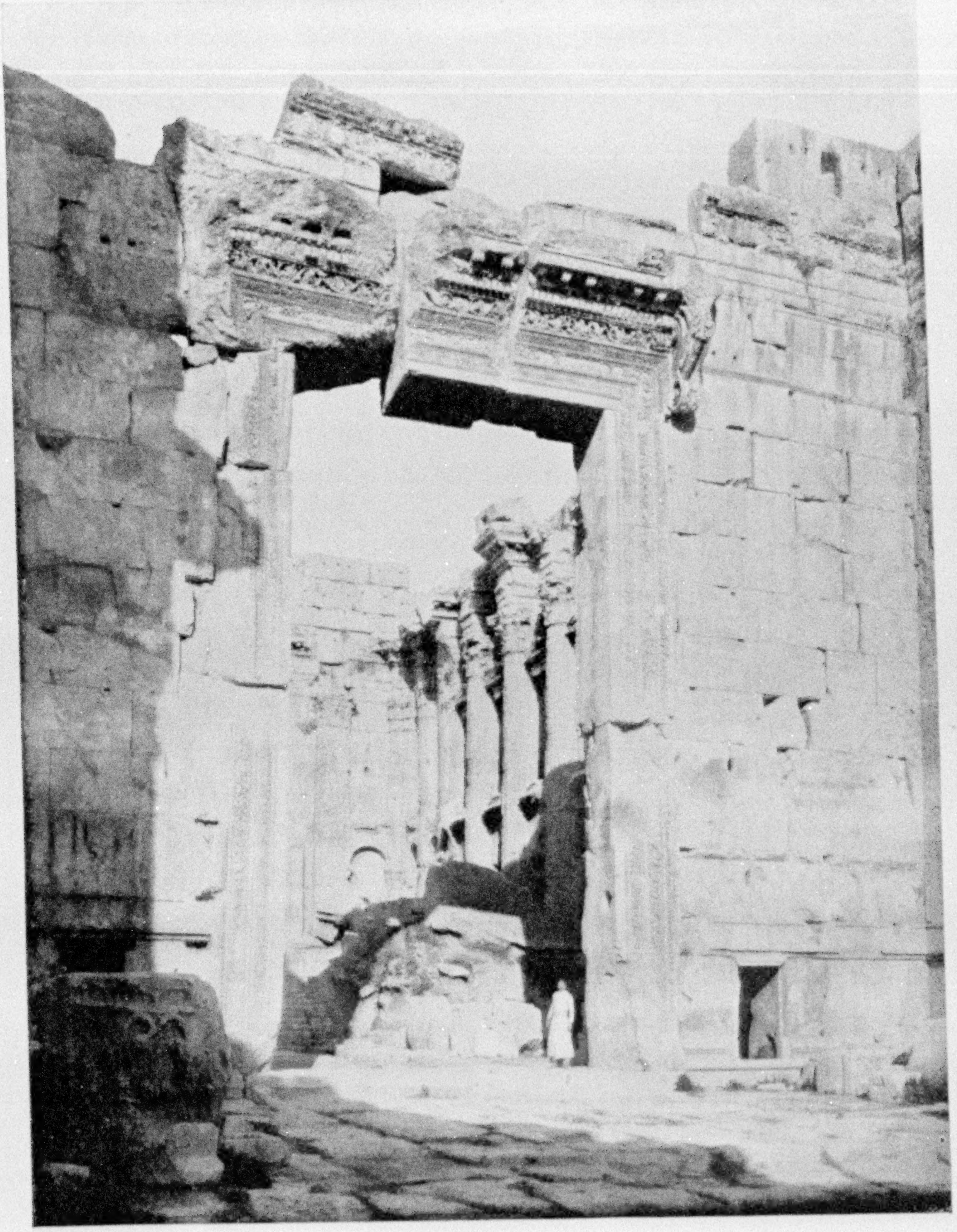
ANOTHER VIEW OF THE TEMPLE OF BACCHUS: BAALBEK

Note the native standing on the left, near the last column, by which some conception of the size of the ruins can be had. Note also the height of the entablature (see text, page 99)



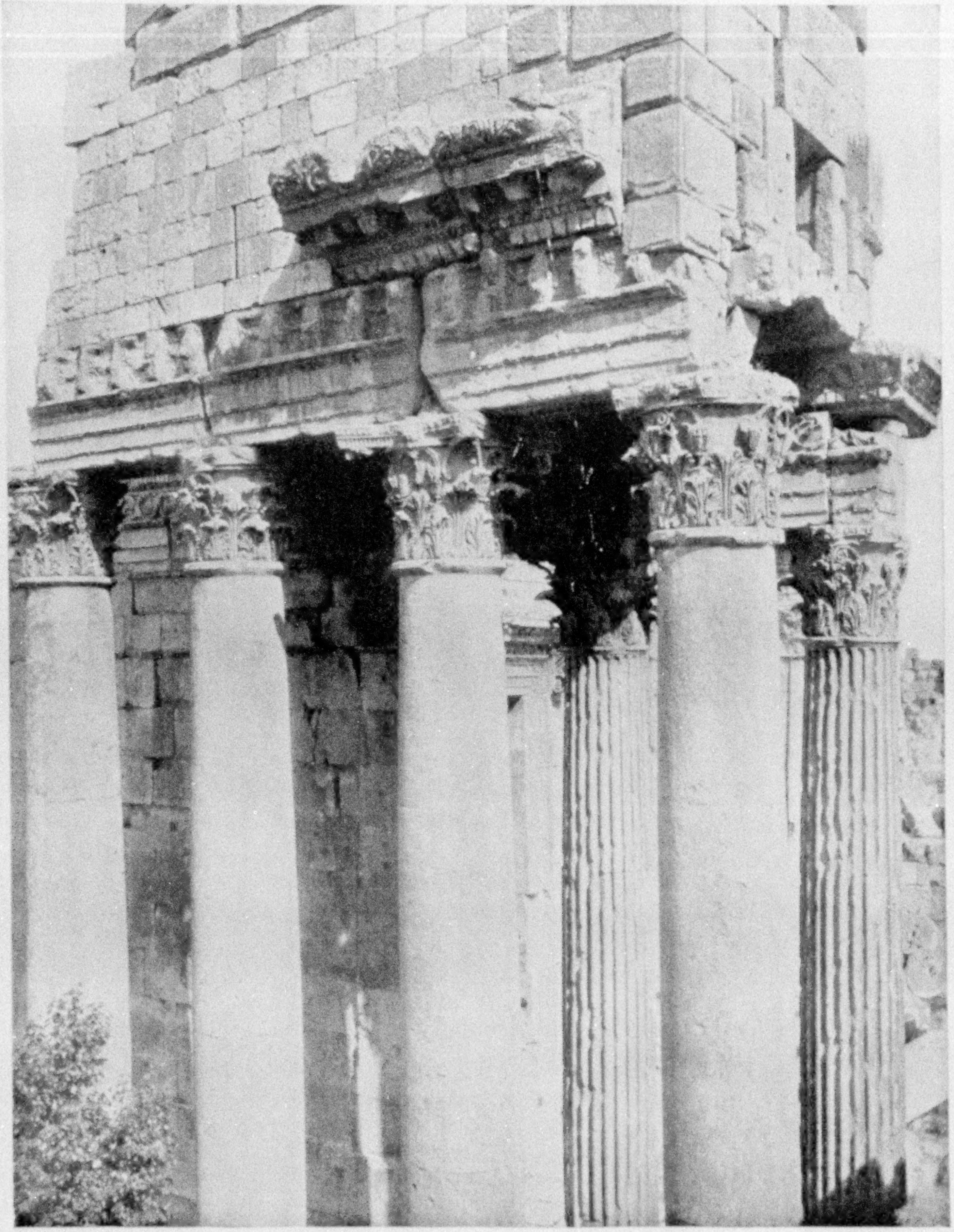
LOOKING OUT THROUGH THE GREAT DOORWAY, TEMPLE OF BACCHUS

The native in the doorway supplies an approximate scale of measurement. Note how, through the cleavage of the inside face of the door post, to the right, the winding stairs leading to the top of the building are exposed.



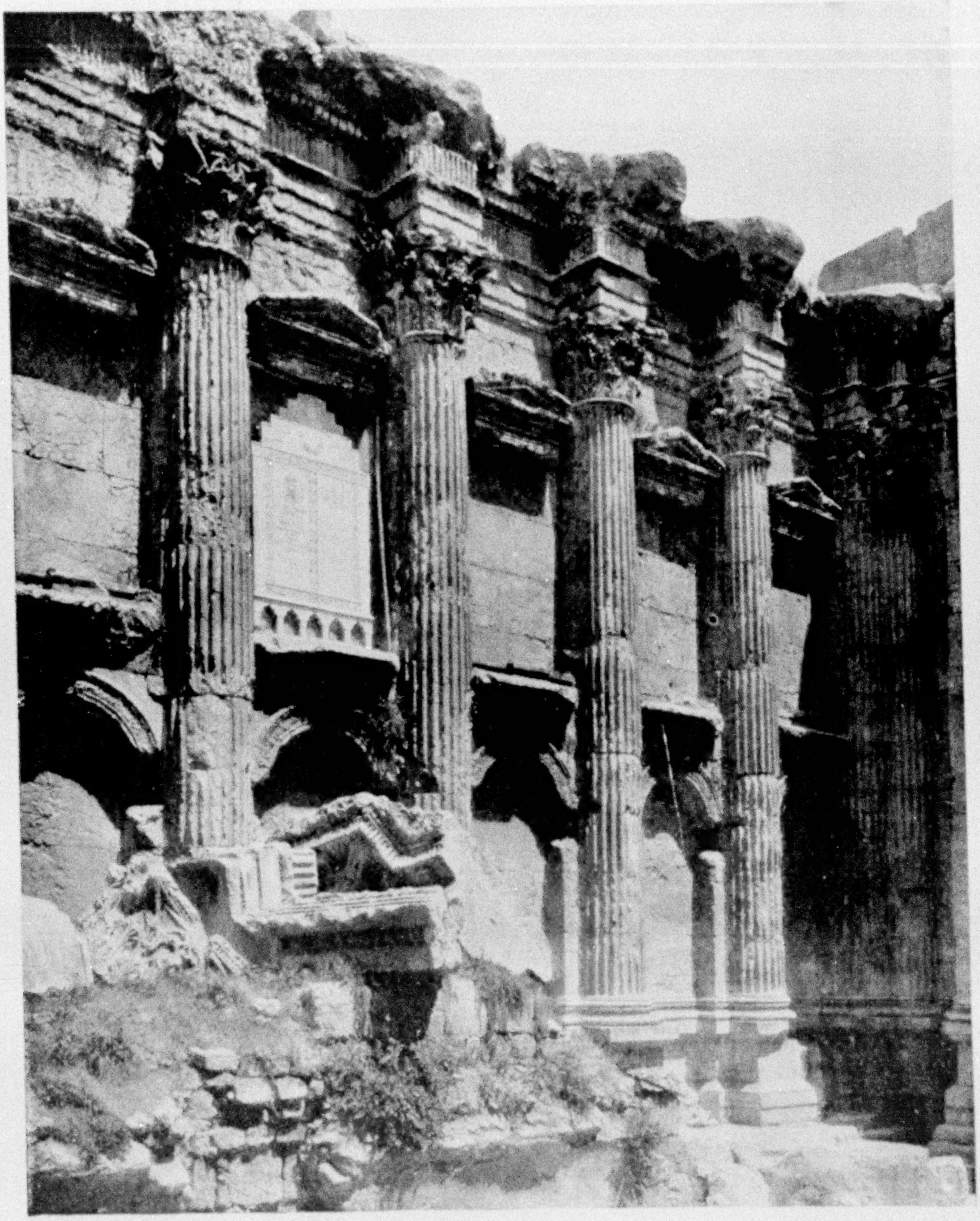
THE GREAT PORTAL INTO THE TEMPLE OF BACCHUS (SEE TEXT, PAGE 101)

The view of this exquisite portal was long obstructed by an Arab screen in the vestibule. This was removed by the famous orientalist, Sir Richard Burton, when he was British consul at Damascus, in 1870. He also propped up the cracked door-lintel, which has since been more firmly secured by the German archeologists.



EXAMPLES OF PLAIN AND FLUTED COLUMNS, TEMPLE OF BACCHUS

Note the great doorway seen between the columns. The structure at the top of the picture is the remains of the Arab fortification, which is also shown from the other side in the picture on page 90 (see text, page 101).



INTERIOR OF THE TEMPLE OF BACCHUS

On the wall to the left is a tablet in late Arabic art, put up by the Turks to commemorate the German Emperor's visit in 1898. The modern and ancient styles of art may rudely clash; but as the visit resulted in the expedition under Professor Puchstein, it well deserves commemoration (see text, page 89).

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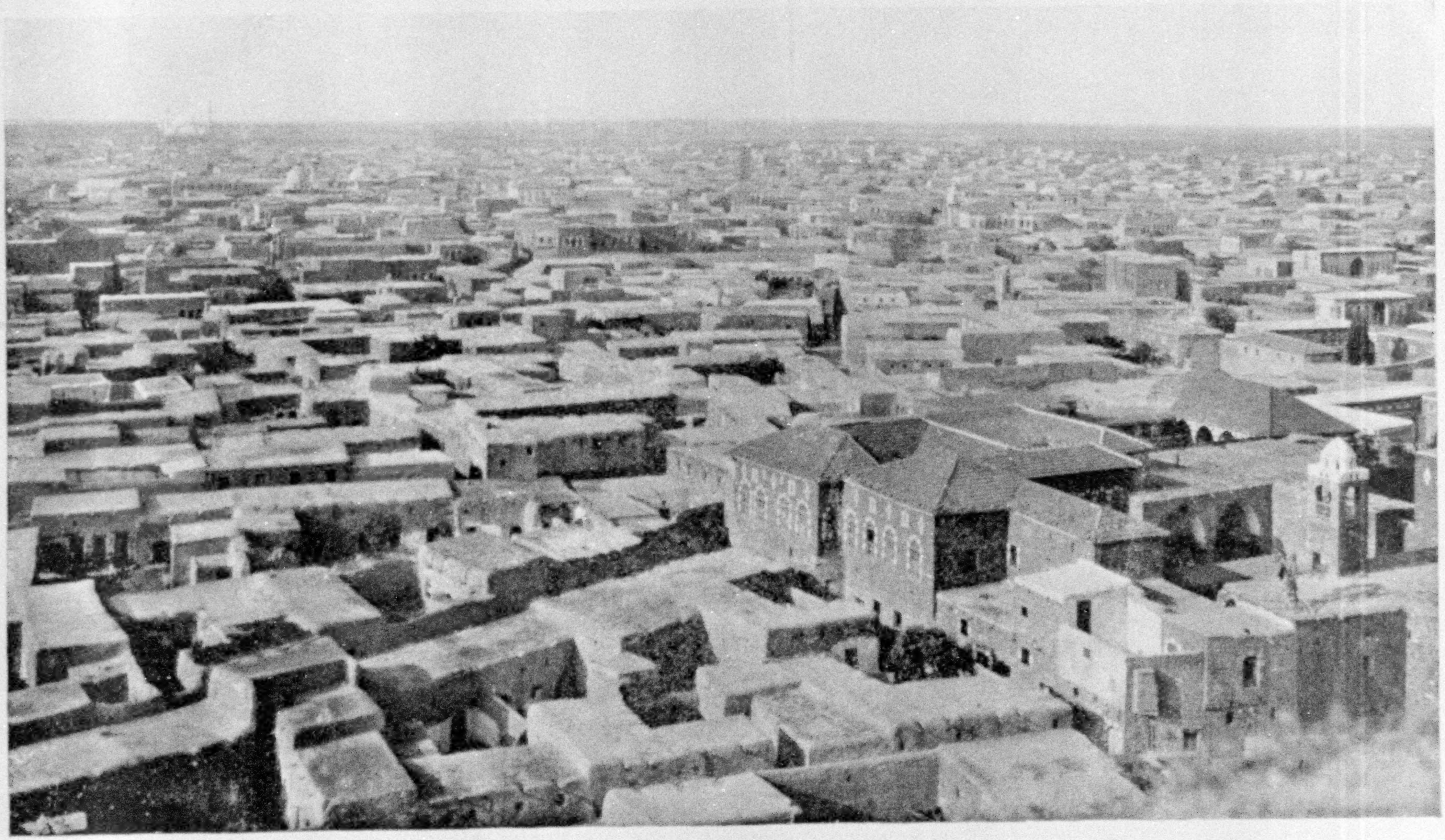


GENERAL VIEW OF HOMS

Note examples of poorer and better styles of houses in the foreground. One of the square minarets mentioned in the text is seen in the right foreground every visitor owes them a debt of gratitude. They not only dug down and removed the debris, but strengthened weak parts, and, where necessary, they have removed the Arabic work so as to make the original plan more easily comprehensible to the visitor. However, it was not entirely a disinterested work, for the Berlin museums now possess many of the finest examples of the carvings found here.

The workmen built a narrow staircase where the broad old one used to be, have torn away the wall constructed over the bases of the columns, and have opened an entrance through a great block of stone which was placed across the central doorway into the forecourt, so that today we enter again as did the Roman worshipers of old.

Proceeding inward we pass through a triple entrance into the Great Court, or Court of the Altar. It is about 440 feet long by 370 feet wide. The central portal, as well as one of the smaller side ones, has fallen in, and the pieces which formed the arches have been collected and laid together on the ground below the place where they had originally been.

Around this court, on three sides, omitting the west end, where a staircase led up to the level of the Great Temple, are square and semicircular exedræ, each of which contain many handsome niches for statues, of which, unfortunately, not a single example remains. These were designed as resting places for the devotees who came here to worship. In front of these exedræ ran a colonnade of polished Egyptian granite surmounted by an entablature bearing carvings of rare beauty. The columns have all fallen and now with fragments of their entablature and capitals lie about the court.

HOW THE CHRISTIANS USED THE TEMPLES

In the center of the court, rather nearer to the steps ascending to the temple, stands what is left of the large altar. On each side of it is a pool or basin used for ablution in connection with the religious rites here observed.

When these temples were taken possession of by the Christians, a church was erected over this altar, part of which was destroyed, and then the space leveled up with the earth so that the church floor was above the top of the altar; so, also, the lower part of the staircase was filled over, while the upper part was removed to accommodate the apses.

The construction of this basilica is attributed to Theodosius, Roman Emperor of the East, who reigned towards the end of the 4th century of our era. The Great Temple was demolished to furnish materials for the construction of this church.

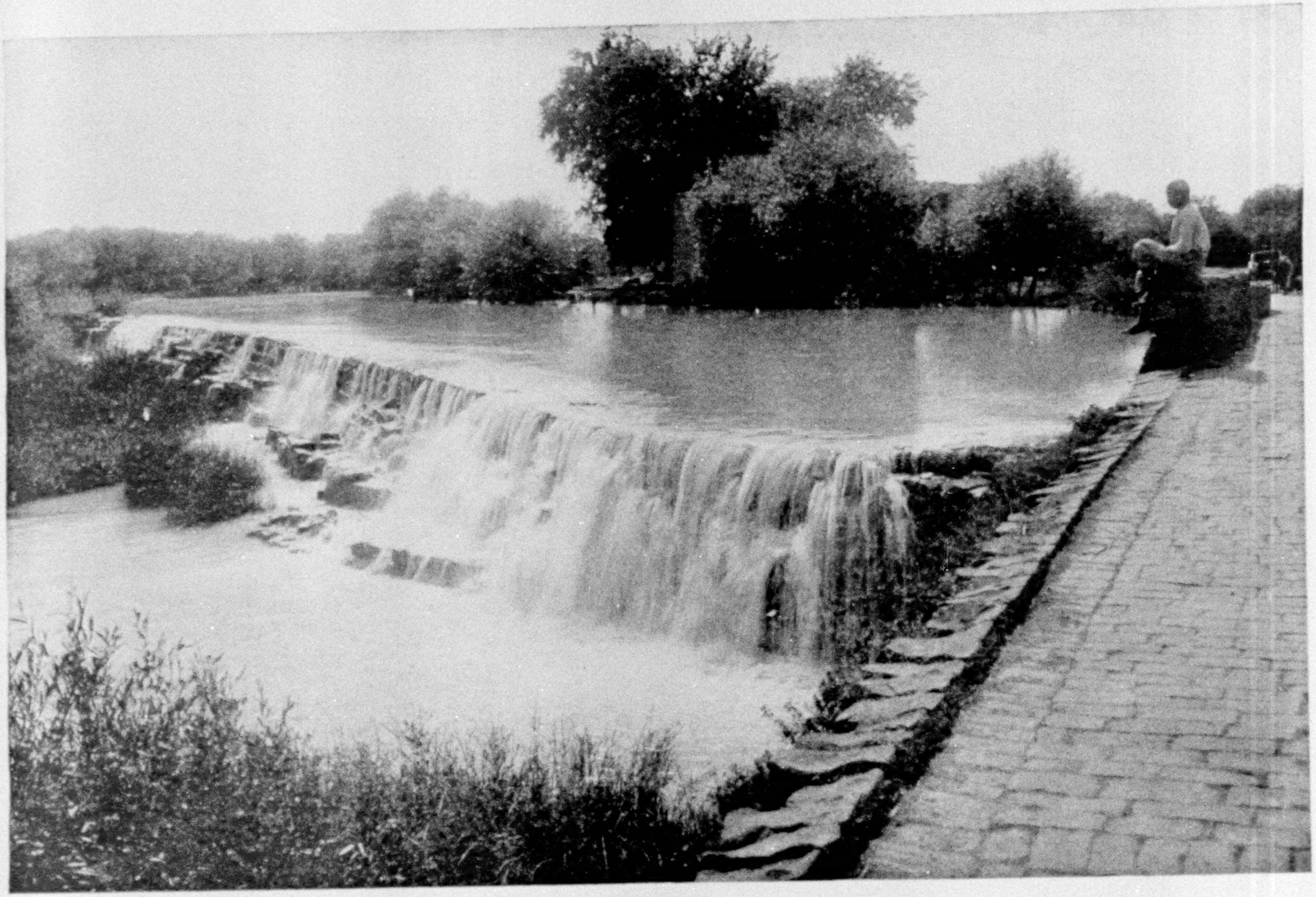
The idea was to obliterate heathenism by placing this Christian shrine right in the center of this renowned temple of the heathen gods. As it seemed to work in best, the apses were placed as above described on the west, with the entrance from the east. Later this was considered unorthodox, and an apse or apses were built at the west end, so that now traces of them appear at both extremities of the ruins.

The Great Temple itself has been almost entirely destroyed. All that is left are six columns of the peristyle, still standing *in situ*, capped with Corinthian capitals and joined by ornate and massive entablature. These lofty pillars do not taper as they appear to do when seen from below (see page 86). They are over 60 feet high and 7½ feet in diameter and are each composed of three drums. The deep entablature is also in three layers, the uppermost, or cornice, having a gutter cut in its upper edge to receive the rain water from the roof, and at intervals mammoth lion heads with open jaws serve as spouts. In all, this entablature measures 17 feet in height (see page 88).

THE TEMPLE OF BACCHUS

One can perhaps best mentally reconstruct the Great Temple by an inspection of the smaller one, dedicated to Bacchus, which lies to the southeast of the Great Temple, entirely independent of it and on a lower level (see pages 92 and 93). It had no court, but was entered by a flight of steps from the east.

The walls of the cella, which is oblong, are quite plain on the outside and are built of carefully dressed stone, the



THE RIVER ORONTES AT HOMS

The name Orontes was used for this river in classical times, and it has also been known as the Draco, Typhon, and Axius. It is mainly unnavigable, and is of little use for irrigation; but the valley through which it flows has long been a highway of North and South Syria.

joints so perfect that a knife-blade cannot enter between. Around this at a distance of 10 feet runs on the two sides and ends a row of smooth columns which forms the peristyle.

These, including their capitals, are about 52 feet high and are surmounted by a magnificent entablature. This entablature is connected with the walls of the cella by enormous slabs of stone, which are elaborately carved with the heads of emperors, deities, and interwoven with floral designs, forming an exquisite ceiling.

While the walls of the cella are still perfect, more than half of the columns forming the peristyle have fallen, the north side being the best preserved. Notwithstanding the profuse ornamentation of the peristyle, it is exceeded by that of the portal to the temple, which is indeed the gem of the entire edifice (see page 95).

The door posts are elegantly carved with figures of Bacchus, fauns, cupids, satyrs, and bacchantes, woven around which are grape-vines and clusters of fruit, also poppies and ears of wheat, all of which are symbolical of the attributes of the revelling god to whom the temple is dedicated.

This great doorway stands 43 feet high and 21½ feet wide, while the carving of the posts just mentioned covers a space about 6 feet wide. On both sides of this door stand graceful fluted columns, forming the prostyle or portico, while the plain ones of the peristyle, which stand behind them, seem to reflect their beauty.

The decorations of the walls of the interior of this temple resemble the carvings of the exedræ of the Great Court, having two rows of niches for statues one above the other and divided perpendicularly from each other by engaged fluted columns.

As already mentioned, these temples stood on a raised platform resting on substructures. The Great Temple lies 44½ feet above the level of the plain and is the highest part of the entire inclosure, while the Great Court was only 23 feet lower.

THE ENORMOUS MONOLITHS OF BAALBEK

An inclosing wall, the mammoth stones of which have been the marvel of engineers for ages, deserves mention. The lowest courses are built of stones of moderate dimensions, but which grow rapidly in size until we come to a row of three enormous stones, the shortest being 63 feet and the longest 65 in length, and each being about 13 feet high and 10 feet thick. The course of which they form part is some 20 feet above the surface of the ground.

They are the largest building blocks ever known to have been used by man; and a still larger one lies in the ancient near-by quarry, never having been detached from the rock beneath. This one is 70 feet long by 14 by 13 feet.

In addition to the Acropolis, as the ruins described are called, there are at Baalbek several other objects of minor interest, such as the Temple of Venus.

At the hotel in Baalbek we met an interesting Turk. He was traveling, being sent out by a newly established department of agriculture at Damascus, with a carload of American and European farm machinery for sale or exhibition to the peasants. He had a very clear conception of the reforms needed to aid the agriculturist in Turkey, and his eyes snapped with delight as we drew from our scanty knowledge of what the Department of Agriculture at Washington had done for our American farmers.

A short train ride northward from Baalbek, first through a flat valley which broadened into a plain, brought us to Homs, a town of some 60,000 inhabitants, located on the banks of the River Orontes, which here flows far below the level of the plain, so that the town lies cradled, invisible to one approaching it, until almost upon it.

A large mound rises to some height above the level of the valley, on which at one time stood the citadel of the town. The houses are built of unbaked bricks and have flat roofs, with some better edifices constructed of black basalt decorated with white limestone. There are numerous minarets, but very unlike the

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ordinary type. They are square and do not taper upward, and instead of a balcony arrangement for the muezzin, or caller to prayer, a window is provided on each side, the top terminating in a sort of dome.

THE UBIQUITOUS ADVERTISEMENT

Homs, the ancient Emesa, which has a varied and interesting history, today gains its living as a market for the large Bedouin tribes of the adjacent country. The bazaars remind one quite a good deal of Damascus, as one wanders through them, seeing here a man working a primitive hand loom, on which he turns out bright fabrics for which Homs is noted, and there a small spice shop, and again a dyer, with hands stained dark with indigo, hanging up his wet cloths in the street.

When we had lost ourselves in these strange surroundings, which seemed to place civilization at a remote distance, our eyes were struck by a placard, on which appeared in bold English "Use Fel's Naptha Soap."

On the outskirts we came across numerous potters' shops, where large water jars, some 20 inches high, were being turned out by ancient methods. The plain ones retailed at 2½ cents each, while those striped with bands of red and otherwise decorated sold at double this price. Further on were extensive threshing floors, where the grain was being threshed out with appliances that have probably been in use for thousands of years.

Here we also found limekilns, the fuel being a common pricker that grows in the wheat fields and which has to be collected and transported from a distance requiring two to three hours' travel (see page 103).

We were often told that we would find the people of Homs and Hama very fanatical and anti-European, but our experience did not bear this out. We found them very polite and not averse to being photographed.

Moreover, we never heard the familiar word "bakshish," the only person who asked for a tip being a tired native woman, who had been carrying bunches of thorns all day to the limekiln, when she was asked to hold her bundle up while a picture was being taken. When the money was handed her she seemed to be ashamed of herself and only took it after much persuasion. The secret lies in the fact that they have not been spoiled by Europeans.

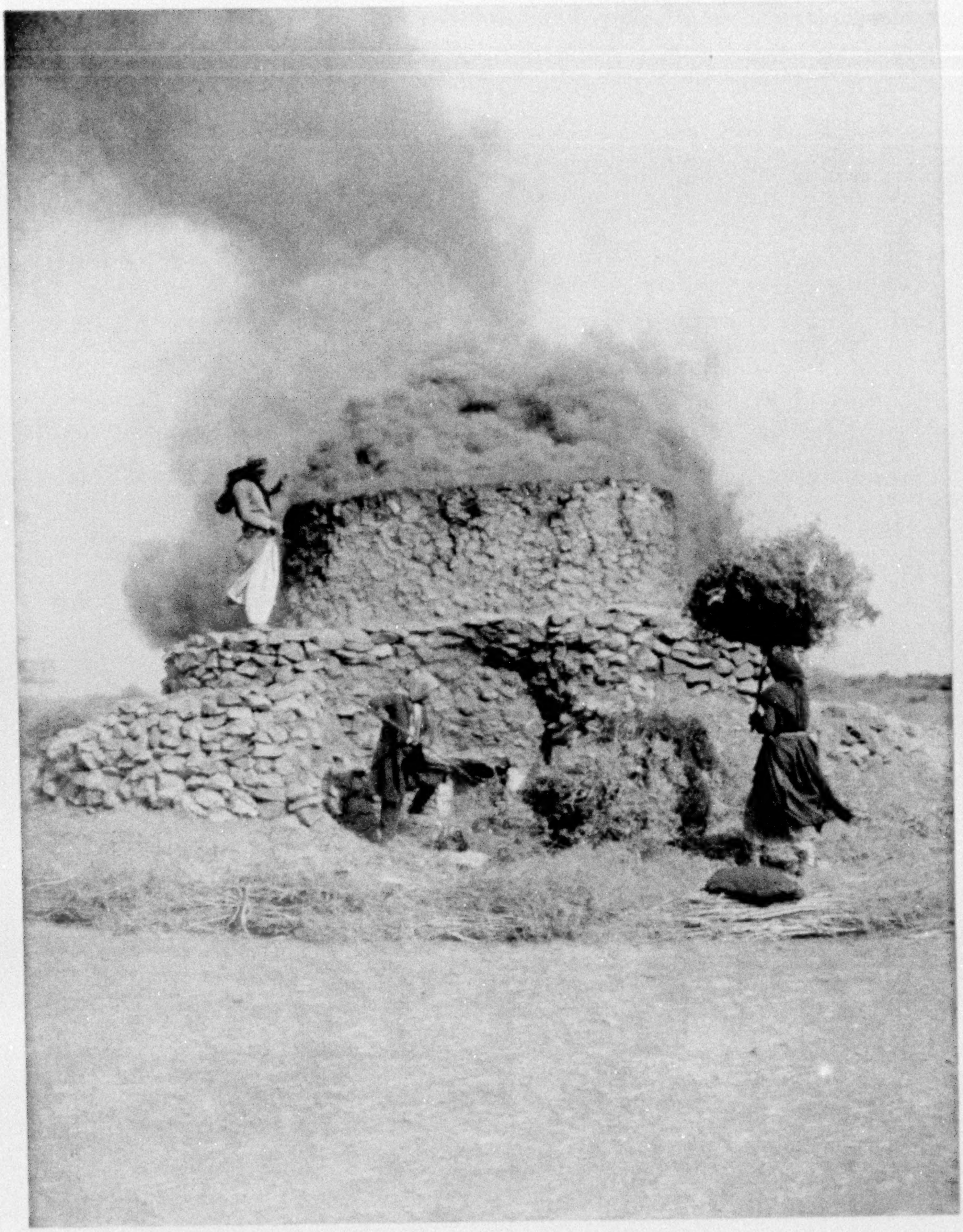
If you want to see the Arabs at their best, take them where they have not been tainted by outside influence, for, like most primitive peoples, they more readily take on the vices than the virtues of civilization.

A TEST OF KEEPING RAMADAN

On our return to the town we were stopped by a native, who seemed to be a friend of our carriage driver and who asked him if he was keeping the fast. The driver replied that he was. "Then," answered the friend, "by Mohammed, the prophet of Allah, show me your tongue." The driver produced that member and the questioner used both hands to draw the jaws open wider in order to complete his examination, after which he turned away, shaking his head with a kind of unexpected satisfaction, muttering to himself, "By Allah, he is really fasting." We said nothing, for not long before we had seen him, while waiting for us, go into an obscure corner to satisfy his hunger with some bread he had with him.

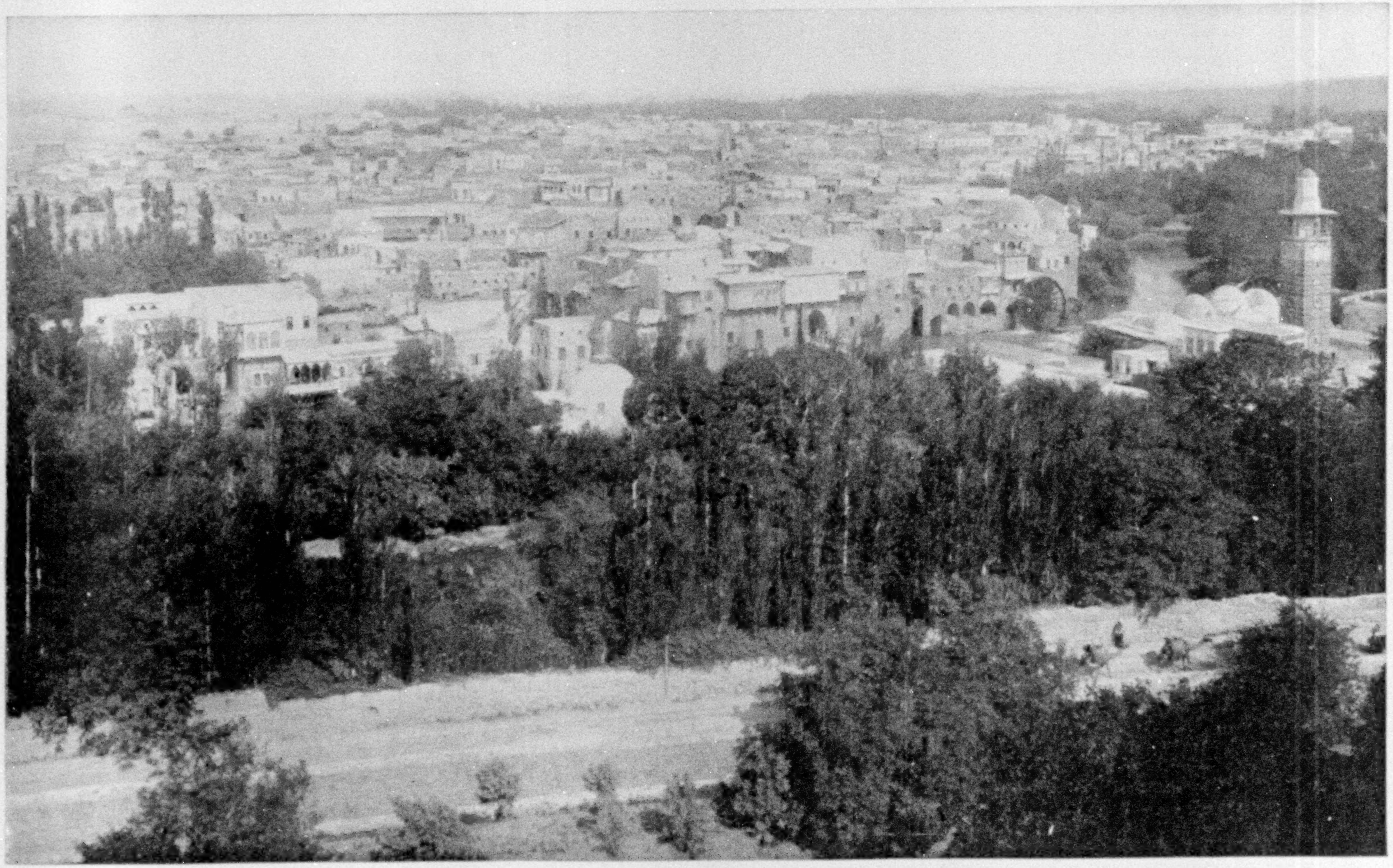
Curious windmills are to be seen here on the tops of some of the houses. Round disk-like pans of sheet-iron are fastened to wooden arms and are so disposed that the wind striking them causes them to revolve.

A curious custom also obtains of ensnaring domestic pigeons. Our attention was called to it by seeing a man on his housetop swinging round over his head what resembled a huge tennis racket, only instead of the tight strings a loose bag was attached to the frame. Over him hovered a large flock of pigeons. We were told that his own pigeons decoyed others which followed and were caught. After being taken, if they proved to be the property of a friend they were returned, but if of an enemy they were kept. They did not regard it as stealing,

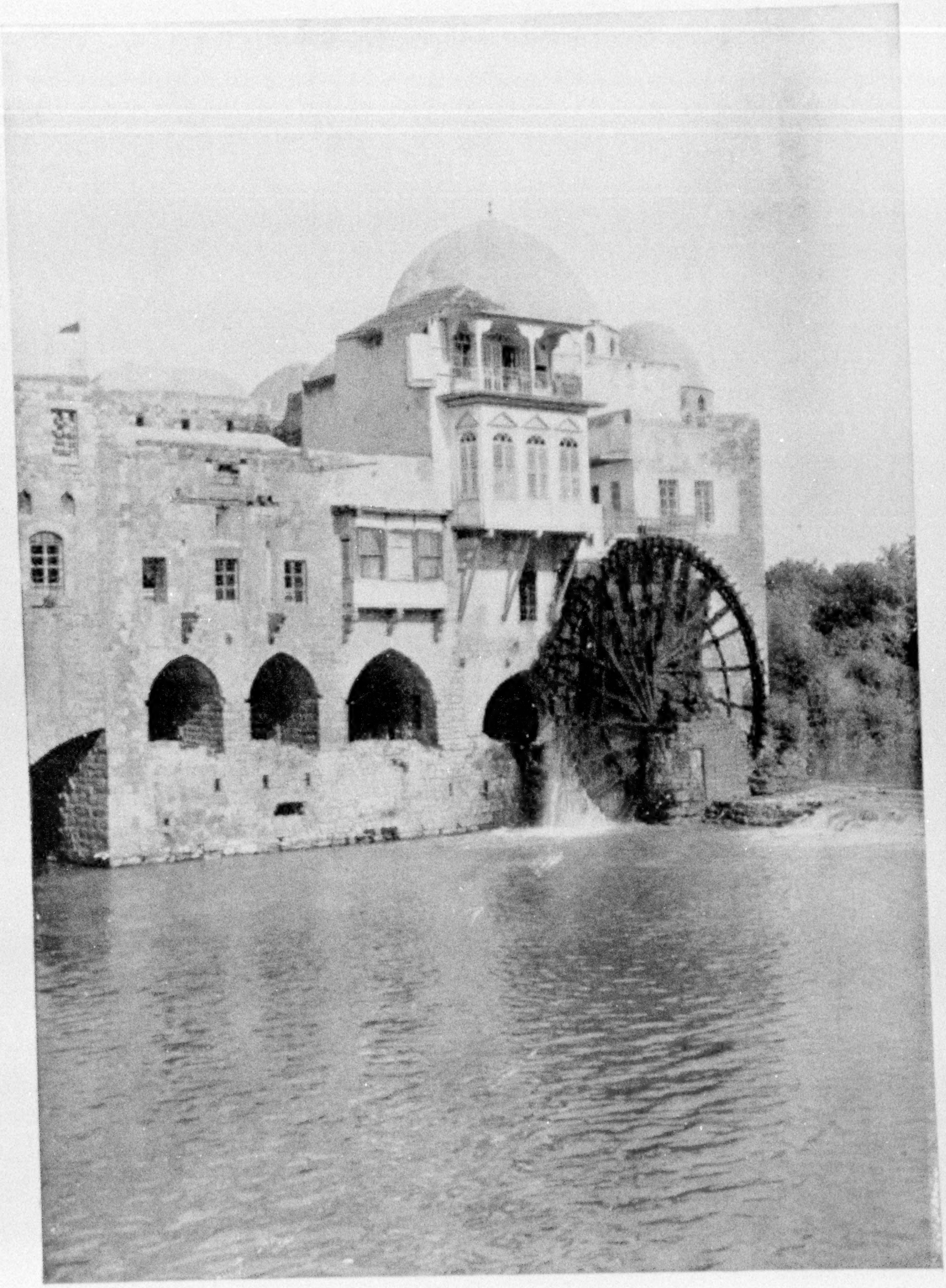


A NATIVE LIMEKILN

Large tracts of Syria are completely destitute of trees, and consequently anything in the nature of fuel is exceedingly scarce. Often the only tree to be found is a small, scrubby thorn bush, which nevertheless has its value. The woman shown in the picture had collected fuel for this limekiln at a distance requiring between two and three hours' travel.



GENERAL VIEW OF HAMA: NOTE THE WATER-WHEEL ON THE MIDDLE-RIGHT OF THE PICTURE



WATER-WHEEL AT HAMA CALLED "NAURAT EL KELENEY"

These water wheels, which in working make the most curious and discordant noise, not unlike a brass band in which every instrument is out of tune, not only serve to supply the town of Hama with water, but they also irrigate the adjacent gardens (see text, page 109)

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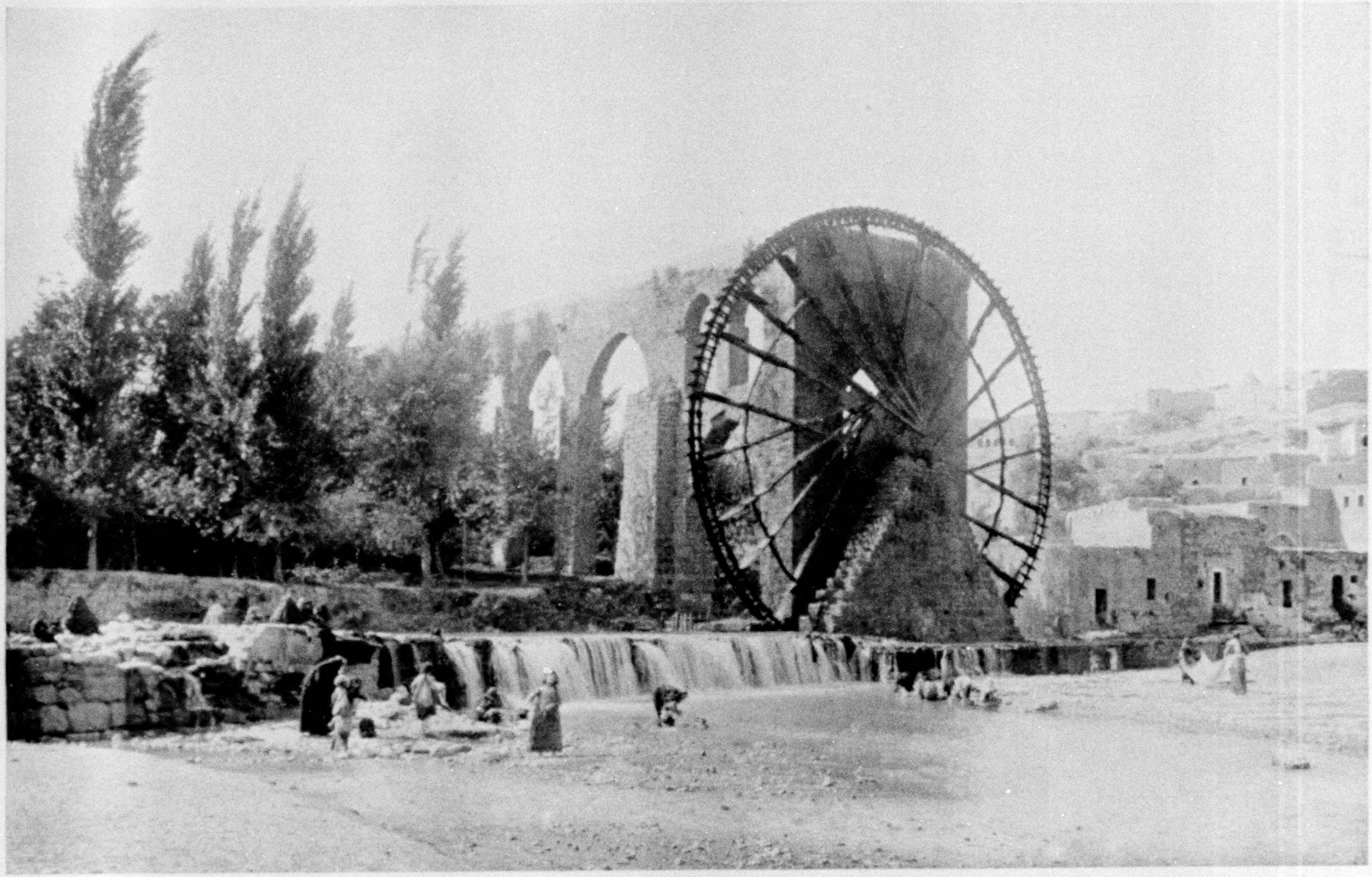
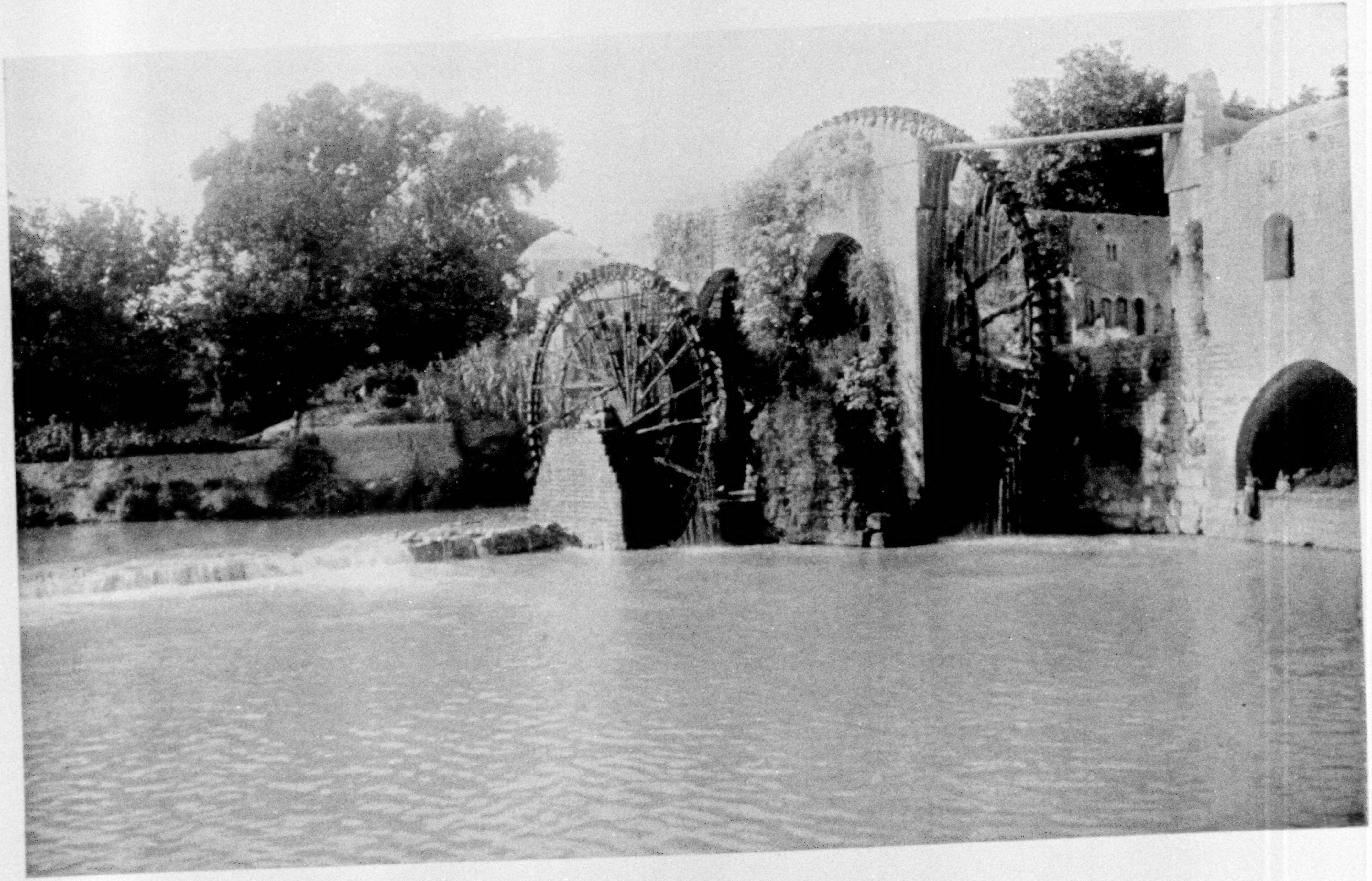


THE LARGEST "NAURA" AT HAMA, ABOUT 75 FEET IN DIAMETER: NOTE THE ARCHED CONDUIT, WHICH CARRIES THE WATER TO THE GARDENS



A DOUBLE "NAURA" AT HAMA

The largest is about 60 feet high. They are driven around by the swift motion of the river, while small buckets on the rim take the water up. Note the boy dropping back into the river after having gone up part way (see text, page 111)

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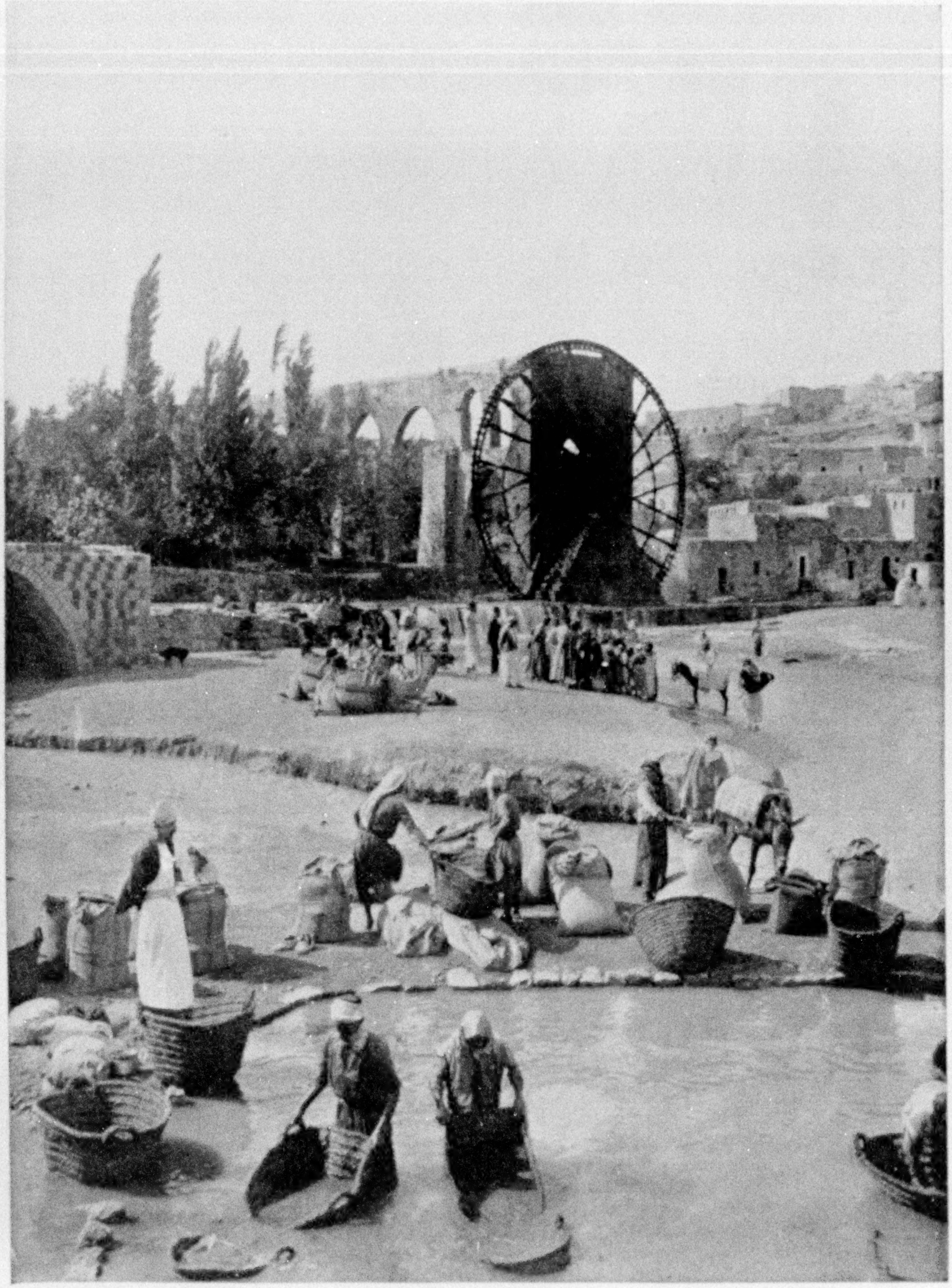

NATIVES OF HAMA WASHING WHEAT IN THE ORONTES

It is then parboiled and ground in mills, making "borghal," which is the chief food of this region. The women shown in this picture are all peasants and do not veil their faces but viewed it from the same standpoint as the Bedouins, who raid their neighbors for what they can get from them, as long as they are not friends.

HOW THE ORONTES GETS ITS ARABIC NAME

The country over which we passed after leaving Homs was at times quite level and free from rocks, planted in watermelons and yellow corn; then again it would become quite rocky and covered with boulders of tufa; and still again, as we neared Hama, level and rich with extensive vineyards. The fallow ground was as if sown by nature's hand with countless wild holly-hocks in bloom. At times the road ran quite near the edge of the Orontes, whose turbid waters flowed along many feet below the level of the surrounding plain.

It is called in Arabic "El Asi," which means stubborn or unwieldy. We asked a native why this name was given to the river, and he gave the following explanation: "A Jew once filled a bottle with water from the 'Sea of the Nile' (the Arabic name for the Nile River) and came to this country to perform magic with it. Our Lord Ali[*] met him and asked what he had. The Jew denied that he had anything, but when hard pressed, he threw the bottle against a rock and a river issued forth. Our Lord Ali bade it stop, but it would not, and so he named it El Asi." A fellow-passenger questioned if this were an actual fact, to which our informant replied that a look at the color of the water proved it, for it was exactly like that of the Nile.

Finding our friend communicative, we asked him what use this corn was put to which here grew so plentifully, but was not known in Palestine. Opening his capacious jaws and gesturing with his fingers, he answered, "To eat; and when the loaves are hot they are mighty good, but when cold it would take one of Ibrahim Pasha's cannon to force it down one's throat."

THE HOME OF THE ARAB GEOGRAPHERS

Shemsi Bey, to whom we had a letter of introduction, met us at the station at Hama and took us to his home, where we were guests during our stay. After a sumptuous repast, we began our inspection of the town. It much resembles Homs, and like it is located on the Orontes, has a mound crowned by a citadel, and cannot be seen until one is right upon it.

Like every part of this region, Hama has a checkered history. It is first mentioned by the prophet Amos as "Hamath the great" (Amos 6:2). A small mosque called Jami el Haiya (Mosque of the Snakes), so named from its two intertwined columns, contains the tomb of Abulfeda, Prince of Hama, whose geographical work is still renowned. Under his rule Hama prospered until his death, in A. D. 1331.

The famous Arabian geographer, Yakut, is said to be a native of Hama, and while we were there we heard of a manuscript written by him which is in the possession of one of the rich families of the town.

If one would know the full beauty and picturesqueness of Hama, let him climb to the top of the citadel hill, and around will be spread out a scene which cannot be outdone in Syria. An Arabic proverb says that three things make the heart of man glad—water, vegetation, and beautiful faces. Here we have the first two, and other features in combination, whose value is enhanced by contrast with the arid lifelessness of the country which surrounds it, for at the time we were there the wheat fields were all harvested and bare.

THE WATER-WHEELS OF HAMA

The Orontes flows through the town and drives the large water-wheels, here called *naura*. They serve not only to supply the town with water, but also irrigate the adjacent gardens. We had long before heard of these singular wheels, and in fact had seen similar ones at Antioch. As we began the ascent of the citadel hill, creaking, groaning, and other weird sounds reached our ears. It at first suggested a pipe-organ, then a brass band practicing, and it was not until, after a little time, the top of one of them came into view that we realized

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[*] Ali, the caliph and successor of Mohammed.

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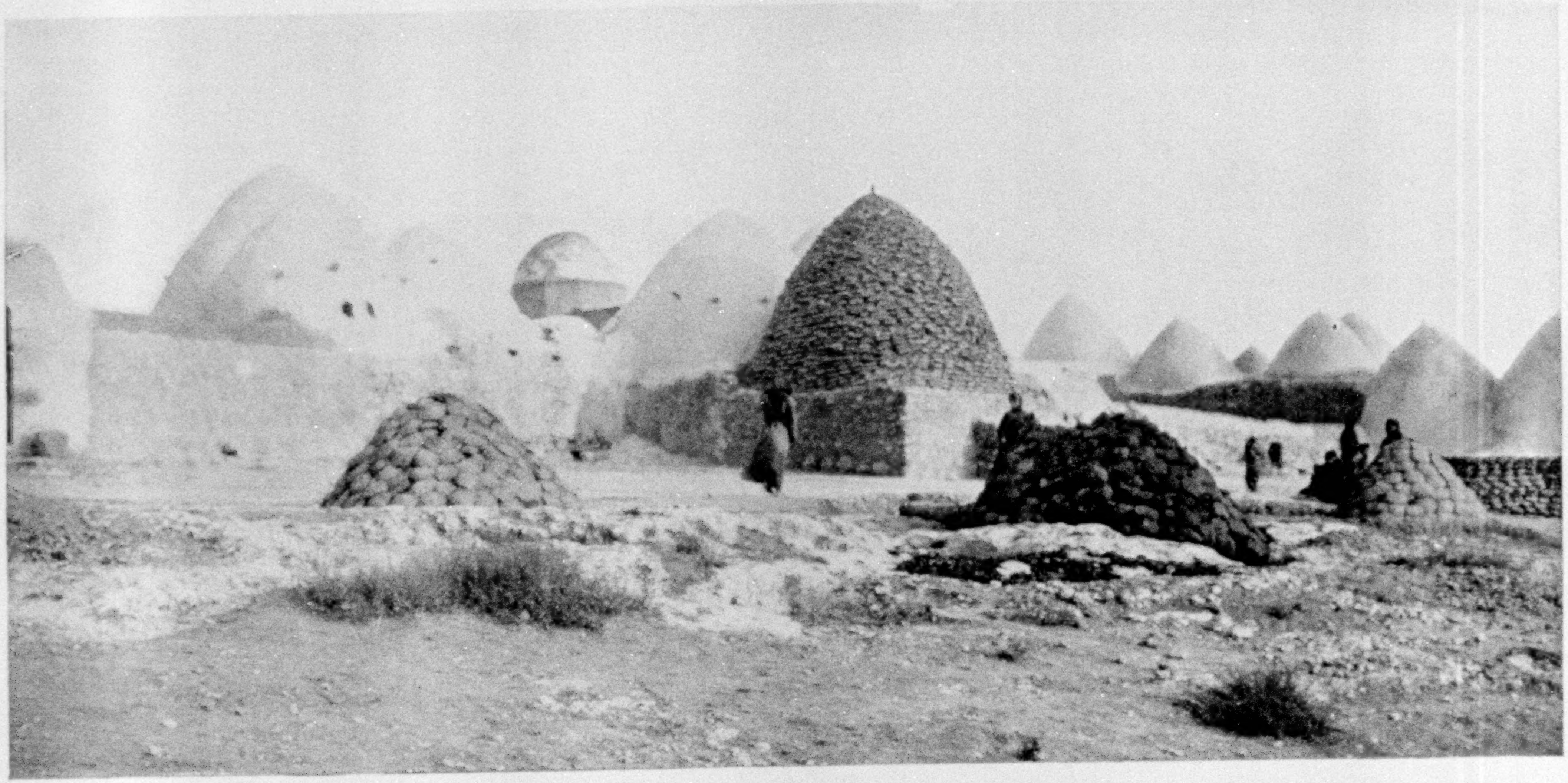

ONE OF THE PECULIAR BEEHIVE HOUSE VILLAGES NEAR ALEPPO

One is seen without its outer coating of clay. The smaller conical piles are of dried manure, used for fuel that these sounds came from the water-wheels.

A large crowd of men and boys followed us around during our inspection of the water-wheels and the town, but were very courteous and went out of their way to show us little kindnesses. Small boys bathing in the river would, for fun, get in between the spokes of the wheels and allow themselves to be carried around many times, or they would hang on the outside of the wheel and drop back into the water when half way up, which made the faces of the old men who were looking on beam, undoubtedly reminding them of like achievements in their boyhood days. Our cameras were a source of much curiosity, and a peep at the ground glass was considered a treat.

AN EVELESS EDEN

A couple of long streets arched over with masonry were the chief bazaars and were in their aspect Oriental in the extreme. Here Bedouin men armed with sword and pistols jostled townsmen in a variety of native dress. Not a European suit was to be seen except our own.

A few swarthy daughters of the desert, with their tatooed faces and flowing garments of indigo, were the only females we saw. In fact during our entire stay at Hama we did not see a towns-woman, Christian or Moslem, veiled or unveiled, upon the streets. We understood that the Moslem men are very particular about their harems, and the Christians likewise as to their ladies.

The men are very fond of outdoor life, and spend their summer evenings on the banks of the river sipping coffee and listening to the curious music of the *nauras*.

At Hama one can witness a most crude method of printing cotton goods. The operator sits cross-legged on the ground before a low table, on which is laid the hand-woven cloth. He dips short blocks of wood, with patterns carved upon them, into a dye mixed with gum arabic and presses them upon the goods. It required six to eight impressions to cover the width of the cloth and a great number of them to complete the length of a small bolt, and this tedious operation had to be repeated with every color used. The finished article resembles a very coarse Persian shawl and is sold to the peasants to cover mattresses with.

A VISIT TO THE MARKET GARDENS

As we were going out from our friend's house to visit the *souks*, or markets, our aged hostess, a Christian woman, followed us out into a garden, through which our path lay, and accosted two wrinkled, gray-haired men, one of whom was handling the plow and the other dropping seeds into the furrow. "May Allah give you strength!" sounded the voice of the old lady. "And may Allah strengthen you," replied the two men. "May your crop be blessed," returned our hostess. "By your presence," both murmured. After exchanging more elaborate salutations, which are common among the Arabs, she learned that they were planting corn for roasting ears, but on only half the tract. "We are keeping half to plant with bits of soot," said one, with a roguish twinkle in his eye. "Soot! What do you mean?" "To raise negroes" (slaves), came the reply.

We had now advanced too far to hear the end of the conversation, but on our return we found the old men resting under the trees, sitting on their heels. Their long-legged cows were unyoked and chewing their cud, while the wife of one of the men was cutting up watermelon to feed to a couple of half-starved sheep. We asked how their negro crop was coming on, and did not have to wait for the answer. "Khawaga (gentlemen), we are poor and own nothing. The land all belongs to the Effendis, and they exact the rent from us whether we get a crop or not. Now it is Ramadan, and during the fast they use much water in their homes, so very little of the water the wheels turn up, which we need for our vegetables, gets to us. But we dare not complain. Life is getting so hard here. We realize but one *mettalic* (1¼ cents) for a *rottle* (six pounds) of egg-plant, and tomatoes are only half that price. So I thought if I could only plant some negro slaves they might bring me better returns."

We parted, all laughing, and we walked away reflecting that even here, pinched

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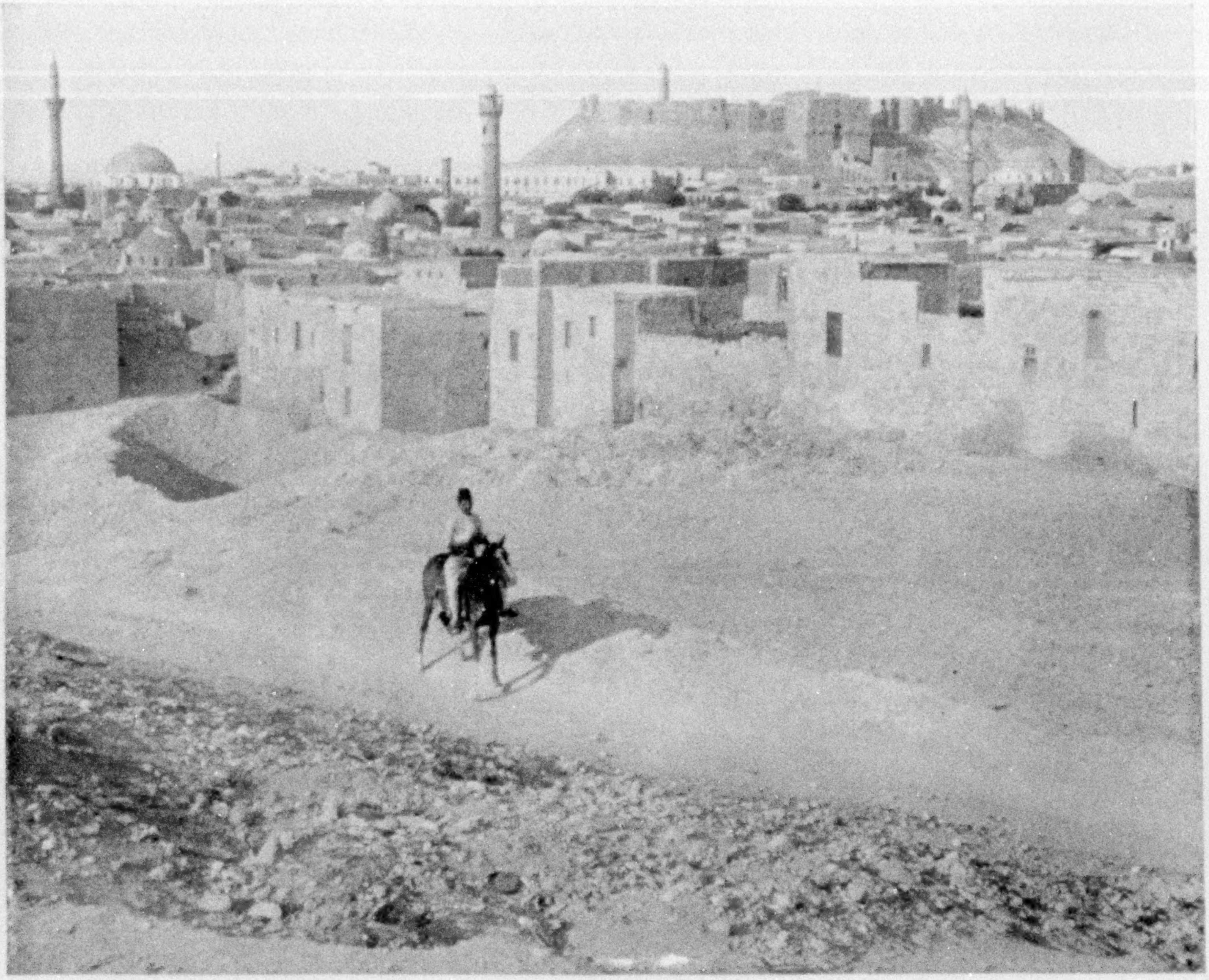


VIEW OF ALEPPO, SHOWING THE CITADEL DOMINATING THE TOWN

Note the round minarets with balconies, in contrast with the square minarets of Homs. A minaret of the type most common in the Moslem world is shown near the great dome to the left of the picture.

by poverty, the heart was still young that throbbed in that dried-up old case.

The low price of many commodities was noticeable. In the market we observed a sweet-meat vendor, on one side of whose tray was a little pile of the money his produce had brought in, but of it all there was no coin representing more than a fraction of a cent.

THE BEAUTY OF THE LARGER HOUSES

Most of the townspeople are rich, and it is said that about two-thirds of the farming land of the surrounding villages is owned by a few of the influential families. The houses of the wealthy much resemble those of Damascus, with a large open court in the center, where a fountain of water plays.

We visited several, one belonging to the heirs of Muaiyad Bey being especially interesting. One guest-chamber contained a small fountain; the windows were of colored glass, and the walls were covered with woodwork, ornamented with carving and stucco work in elegant floral designs, relieved with pictures and inscriptions with dates, one of which made the work about 200 years old. The general color was a commingling of deep reds, blues, green and brown on a background of gold and silver, which were reflected through the semi-transparent colors. One of the panels held a picture of the citadel hill, crowned with a fort, mosques, and houses, surrounded by a wall, the approach to which across the moat resembled the one still to be seen at Aleppo.

Leaving Hama and the Orontes, with its gardens and water-wheels, which extended some way up along the course of the railroad, we found ourselves rolling over a lifeless plain, except for here and there a flock of sheep with Bedouin shepherds. With each flock was a small donkey as a mount for the shepherd, and which followed the sheep almost like one of them, as they ran away in terror of the train.

THE "BEEHIVE" HOUSES

We now came into a region where we found a peculiar style of village, composed of "beehive houses," so called on account of their similarity in shape to the abodes of bees (see page 110).

The country is destitute of trees from which to hew rafters, and in parts there is no stone at all, and therefore the natives resort to building these curious structures of sun-dried bricks with high and steep domes, so as to resist the heavy rain and snow storms which prevail here. Each home consists of several of these huts standing near together and surrounded by a wall of similar materials. One or more is used to live in, another is for the animals, and still another serves as a granary, and so on according to the possessions of the proprietor.

We pulled up at Aleppo, one of the greatest cities of the East, a once somnolent mart, whose past prosperity and importance as a center of commerce is fast returning to it with the advent of the railway, now in the course of rapid construction, which is to connect Constantinople with Bagdad.

HONORS TO AMUNDSEN AND PEARY

THE annual banquet of the National Geographic Society, held on January 11, 1913, at the New Willard Hotel, Washington, was marked by several features of more than usual interest.

The 700 members and guests had the satisfaction of hearing the announcement that the total membership of the Society had grown to the very gratifying total of 170,000, the Society thus ranking, in point of numbers, not only as the first geographical society in the world, but also as the largest educational association in existence.

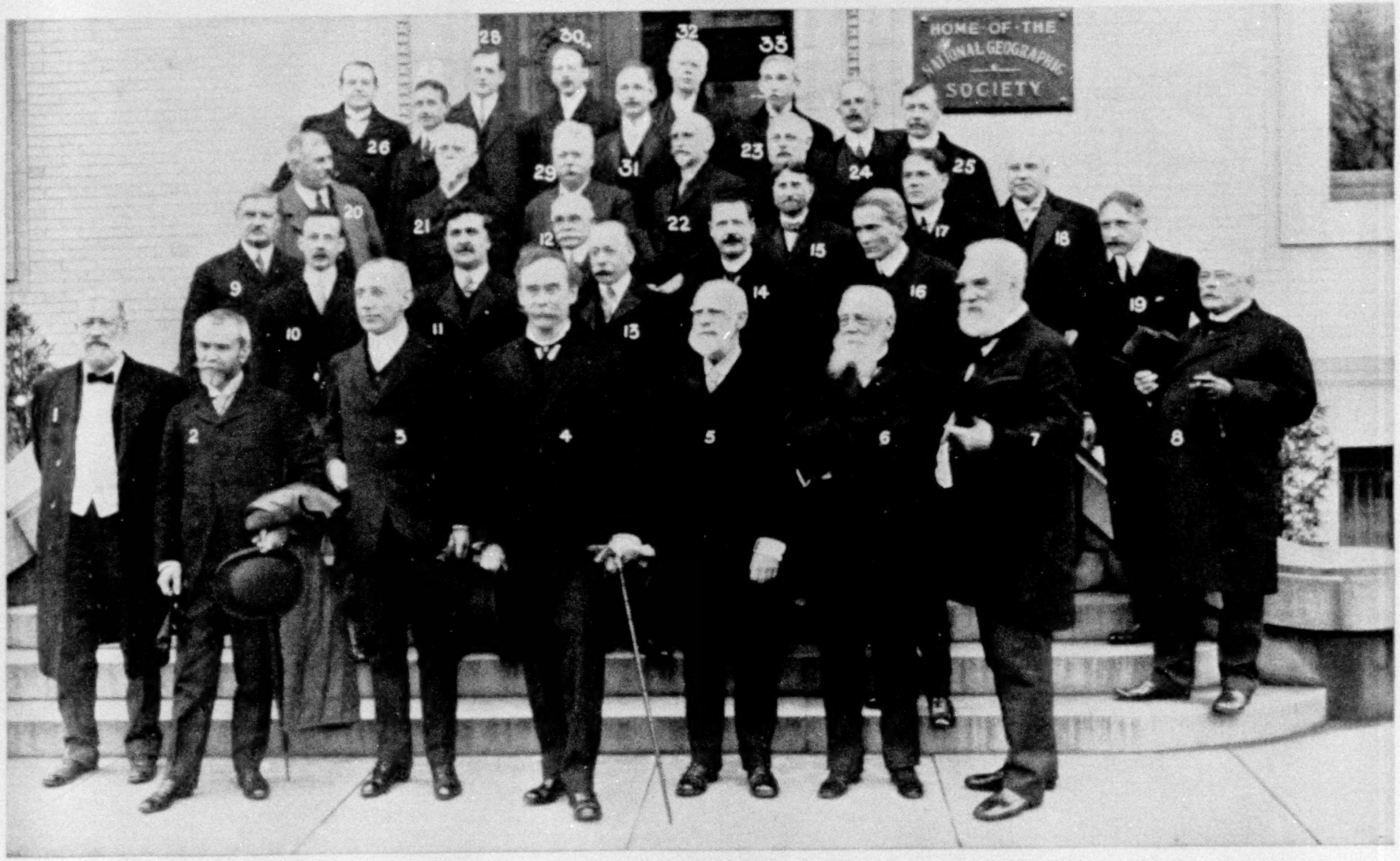
But no statistics, however satisfactory, could have accounted for so large and so distinguished a gathering. It was, as Ambassador Bryce remarked, "an occasion which had never happened before and could never happen again," a unique event in geographic history, for those present saw the discoverer of the South Pole meet the discoverer of the North Pole, from whose hands he received the special gold medal voted by the Society as the tribute of the American people to his great achievement.

With Capt. Roald Amundsen as its guest of honor and Admiral Peary as its toastmaster, the Society had before it two men who had literally come from the uttermost ends of the earth to enjoy its hospitality.

As would be expected on such an occasion, there were representatives from almost all the embassies accredited to the United States and from nearly every State in the Union.

The one note of regret was sounded when Ambassador Bryce, an old and tried friend, made his speech of farewell to the members of the Society. It was a speech worthy of his fame—graceful, witty, learned, and kindly reflecting the personality of the great English statesman and scholar who will soon leave these shores to pass the evening of his life in his native land. When he goes no good wishes will follow him more cordial and sincere than those of the National Geographic Society.

The encouragement of agriculture was represented by the novelty of the menu, which this year consisted of a fruit new to America—the Chinese jujube. These



THE FIRST MEETING OF THE POLES

The first meeting of Robert E. Peary, discoverer of the North Pole (4), and Roald Amundsen, discoverer of the South Pole (3), at the home of the National Geographic Society, January 11, 1913. The other members in the group include J. J. Jusserand, the French Ambassador (2), James Bryce, the Ambassador from Great Britain (5), the Attorney-General, George W. Wickersham (13), the Minister from Norway (14), Hiram Bingham, leader of the Yale-National Geographic Society Expedition to Peru (16), Officers and Board of Managers of the National Geographic Society: President Henry Gannett (1), Colonel Henry F. Blount (6), Dr. Alexander Graham Bell (7), Mr. John Joy Edson, Treasurer (8), Rear-Admiral John E. Pillsbury (9), Gilbert H. Grosvenor, Director and Editor National Geographic Society (10), George Otis Smith, Director U. S. Geological Survey (11), Rear-Admiral C. M. Chester (12), O. H. Tittmann, Vice-President, and Supt. U. S. Coast and Geodetic Survey (22), L. A. Bauer, Director Dept. of Terrestrial Magnetism Carnegie Institution (15), Franklin K. Lane, Chairman Interstate Commerce Commission (18), Rudolph Kauffmann, Managing Editor Washington "Evening Star" (20), Brigadier-General John M. Wilson, former Chief of Engineers, U. S. A. (21), C. Hart Merriam (29), Charles J. Bell, President American Security & Trust Co. (23), David Fairchild, Agricultural Explorer (24), George Shiras 3d, former member of Congress and wild game photographer (25), John Oliver La Gorce, Assistant Editor NATIONAL GEOGRAPHIC MAGAZINE (26), George R. Putnam, U. S. Commissioner of Lighthouses (27), Frederick B. Eichelberger, Assistant Treasurer National Geographic Society (28), Frederick V. Coville, President Washington Academy of Sciences (31), Dr. S. N. D. North (32), T. L. Macdonald, M. D. (33), Edwin P. Grosvenor, Special Assistant to the Attorney-General (30), Peter Stuyvesant Pillot (17), and Julien A. Ripley (19) of New York.

jujubes were grown, dried, and candied in California, where they had been introduced by the Department of Agriculture, and were the first of the home-grown variety to be served at a public function.

ADDRESS BY PRESIDENT GANNETT

Members of the National Geographic Society, ladies and gentlemen: It is with great pleasure that I welcome you here this evening, on the occasion of our 25th anniversary. A quarter of a century ago a few score of men assembled in the Cosmos Club and organized this Society and elected Gardiner Greene Hubbard its first President. The Society has had a wonderful growth in its membership, and today its members number 170,000. The business of the Society has likewise grown, and the total income last year from all sources was $370,000. Of this amount, after paying the running expenses and spending some $14,000 in geographic research, the sum of $50,000, more or less, was added to our reserve fund, which now stands at a total of about $175,000.

We have carried on geographic research this year in Peru and on the east coast of Hudson Bay and have made an examination of Katmai volcano, in southern Alaska, which broke out seriously last summer.

The theme this evening is the South Pole. We are fortunate to have with us Capt. Roald Amundsen, the hero of the South Pole, to whom is to be awarded a gold medal by the Society. The Toastmaster this evening is Robert Edwin Peary, the hero of the other end of the earth. I have the honor to present Admiral Peary.

THE TOASTMASTER, ROBERT E. PEARY

Mr. President and fellow-members of the National Geographic Society: I fancy it is superfluous for me to say to you how deeply I appreciate the honor of being elected by the Society as Toastmaster for this distinguished occasion. I will say to you that I recognize fully that the first qualification for the position of Toastmaster is to let the others do the talking.

Before beginning with the program of the evening I am going to read two announcements to you, the first in regard to the special delicacy which you will have the opportunity this evening to test. I might say that our members and guests always appreciate and welcome the opportunity given us by our friends, the Secretary of Agriculture and his assistants, to test some of the discoveries made in foreign lands by the agricultural explorers of the Department.

Two years ago the members of the Society were the first at a large function to test the American-grown dasheen, imported from China. Last year American-grown dates, imported from Africa and grown in California, were served to us. This year we are given the opportunity of tasting some preserved Chinese jujubes. The story of their discovery in China and of their cultivation in America is told on the printed matter which is placed at every plate this evening.

AWARD OF GRANT SQUIRES PRIZE

The first award of the Society from the Grant Squires fund, relating to commerce and industries of the Orient, has been made to the author of "Farmers of Forty Centuries," Mr. F. H. King. This book is an exhaustive study of the methods by which a very populous nation have been so skillfully cultivating their lands for more than 4,000 years that the fields of China are today more fertile than when first cultivated by man. That is a wonderful record. Mr. King's book represents what the Society believes is an ideal study of foreign places.

This Society, among other efforts in the wide field of research which it has undertaken, has been assisting in exploration in South America, and the first speaker of the evening will be the leader of the Yale-National Geographic Society Peruvian Expedition during the year 1912. This expedition, under the leadership of Dr. Bingham, has performed a most interesting work, and procured, after trials and tribulations, most valuable material.

I have the pleasure of introducing Dr. Hiram Bingham, who will tell us of the home of the Incas and their predecessors.

THE YALE-NATIONAL GEOGRAPHIC SOCIETY PERUVIAN EXPEDITION BY HIRAM BINGHAM

Mr. Toastmaster, ladies and gentlemen: I must confess that I feel rather chilly, having recently come from the tropics and finding myself so close to both poles. In fact I am reminded of an experience a friend of mine had in the Northwest, where so many of our most healthy American citizens are from the land of Captain Amundsen. This friend had the bad taste to try to take an automobile trip, bumping over some of the unmacadamized roads of the district and losing some of his tools. He finally ran into trouble and looked for a farmer to help him out of it. He asked the farmer if he could borrow a monkey-wrench. The farmer looked very sad and said, "I don't think so, my friend. My father he got cattle ranch, and my brother John, he got sheep ranch, but I think it too damn cold here for monkey ranch."

Nevertheless, it is a great pleasure to talk with members of the National Geographic Society about Peru, for one does not have to explain, as my good friend the Minister from Peru has to do sometimes, where Peru is. I went down on the steamer with a healthy young American from Chicago, who was spending some of his father's money in securing an acquaintanceship with South America, and he asked me confidentially a day or two before we got to Lima, if I would please tell him whether Lima was in Peru or Peru was in Lima.

THE EXPEDITION TO PERU

When we got to Lima we received that very cordial reception from the Peruvian government which I have always received on going to Peru. We were given every facility, and it is a pleasure to take this occasion to thank the government of Peru, through the Minister, for the many courtesies we received. In fact those who know the character of some of the mountain Indians will realize that it would have been quite impossible for us to have done our work had it not been for the kind assistance the Peruvian government extended to us on account of our connection with the National Geographic Society and Yale University.

I do not hold it against the Minister that when I got to the wharf in Callao some one (I think it was a reporter from a Lima paper) said to one of the officials to whom I had been introduced, and who was courteously passing all our baggage without any examination or difficulty: "Who are these people?" The customs official said: "Oh, some of them are scientific men." "And who are the rest?" "Well, the rest are professors."

In 1911 we began a topographical cross-section of the Andes, which, owing to the tremendous difficulties of the undertaking and the magnitude of our program, we were unable to complete.

Owing to your generosity, we were able this year to take an expert topographical engineer and a corps of assistants, who did excellent work, and whose work I hope you will all live to be proud of.

We also made a special study of the osteology and geology of the Cuzco region, and came to the conclusion that the human remains found there last year were not nearly so old as had been at first supposed.

One of our principal geographical tasks lay in the identification of several cities and towns described in 1911. In particular, there was that remarkable "White City," a remarkable buried city, away down in the jungles on the Urubamba River, below Ollantaytambo, which place was supposed by Squier and other students of Peruvian archæology to be one of the frontier fortresses of the Incas. Down below this place, and buried in jungle, we found a city called Machu Picchu.

THE FIRST CAPITAL OF THE INCAS

That is an awful name, but it is well worth remembering. The city, built of white granite, is on top of a ridge surrounded by precipices from two to three thousand feet high, above the Urubamba River, at a distance of four or five days journey from Cuzco, the well-known Inca capital. Last year we were not able to do more than make a reconnaissance of this old city, but we realized that it was very important and were anxious to study it more, and to try to find out something about its builders. We could find nothing in the chronicles anywhere. No one, with the exception of a few Indians, had ever heard of it. The name was not known in Cuzco, only a few days' journey away. Nobody in Lima had heard of it.

Fortunately, owing to your interest, and largely through your generosity, we were able to go back this year and spend four months and a half at Machu Picchu. We spent about $2,000 simply in clearing the tropical jungle from these ruins and excavating them, taking off the dirt and decayed foliage that had accumulated for many centuries.

We found the city had 150 houses, built of white granite; palaces, temples, and more especially stairways. We uncovered over 100 stairways of white granite, containing a total of more than 2,000 steps. This does not include several stairways leading off into the jungles and up the side of the mountains, one of which was nearly half a mile in length.

We found also that Machu Picchu was a city essentially of windows. Standing at one point, after we had cleared the ruins, we could count in the walls of the houses about 55 windows—a very extraordinary occurrence. This fact leads me to believe that Machu Picchu was the place from which the Incas came when they started for Cuzco and established the Inca Empire.

When we went down there last year we were looking for Vitcos, the *last* capital of the Incas. By accident, in running down those ruins, we stumbled on the *first* Inca capital. As it was owing to your generosity that we were able to make these and several other important discoveries, I take great pleasure in thanking you on behalf of Yale University. We hope eventually to be able to prove by our excavations and the material we have brought away the connection of Machu Picchu with the later Inca Empire.*

THE TOASTMASTER, ROBERT E. PEARY

I may say, supplementary to Dr. Bingham's brief, modest, and interesting remarks in regard to his work, that his discoveries of these ancient cities have astounded the scientists of the world.

We have with us tonight the beloved familiar face of our old, tried, and true friend, an indefatigable globe-trotter, who has been everywhere on earth except, perhaps, at the poles. He is the representative of our cousins across the sea, one of whom, Shackleton, pioneered the way to the South Pole, and another of whom, Scott, is still down there, or, as we hope, may be now on his way home with a splendid record of exploration and scientific work.

I do not know what Ambassador Bryce is going to talk about any more than you, nor do I need to know; but whatever he says will be worth saying and it will be well said.

His Excellency the Right Honorable James Bryce, Ambassador from Great Britain.

ADDRESS BY THE BRITISH AMBASSADOR, MR. BRYCE

Mr. President, Mr. Toastmaster, ladies and gentlemen: I am very much honored by being asked to say a few words to you this evening, and I feel that it is a real privilege to be present on an occasion so historic that it makes us all feel as if we were historic figures ourselves. This is an occasion—a conjunction of discoverers—that has never happened before and can never happen again.

My friend, Professor Bingham, says that he felt cold in the neighborhood of the poles. I have the honor of being between the two poles and therefore in a warm climate. I suppose I cannot call myself the Equator, for that honor belongs to your President, who is exactly in the middle. May I claim, being nearer the South Pole, to represent the tropic of Capricorn?

It is a great occasion, ladies and gentlemen, when we meet both of the discoverers of these two remotest and least accessible parts of our earth. They have accomplished that which all nations have

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*An early number of the NATIONAL GEOGRAPHIC MAGAZINE will contain a complete account, with 150 illustrations, of Dr. Bingham's remarkable discoveries.

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dreamed of for centuries as doubtfully possible at all, and that has been accomplished by the enterprise, courage, science, perseverance, and faith of two such remarkable men. Their names will go down to the remotest posterity, and it is a privilege to all of us to have met them on the first occasion when they are together. As we heard from Admiral Peary two years ago, so we heard from Captain Amundsen, a narrative of his achievements—plain, simple, straightforward, modest, impressive.

I cannot fancy listening to what he told us today without being struck by the fact that the man who approached his great task in so simple a spirit and with such a forecasting mind showed his qualities in the way in which he told it as well as in the way he accomplished it.

A TRIBUTE TO PROFESSOR BINGHAM'S WORK

You will hear, from those who are to succeed me, more about the South Pole and about what Captain Amundsen has done. Let me therefore say one word about what our friend, Professor Bingham, has done. His modesty has prevented him from giving you anything like a full account of the additions he has made to geographic knowledge. He has cleared up some very long-standing and difficult problems in primitive Peruvian history; he has explained many features of the neighborhood of Cuzco which had puzzled previous inquirers; he accomplished in his previous journey a remarkable ascent of one of the loftiest peaks in the Andes, and he has now secured a mass of archæological material which I think will occupy him and your archæologists in this country years in collating, describing, and interpreting.

I think, ladies and gentlemen of the National Geographic Society, that you may now feel well pleased with the generous liberality which your council exercised a year ago when it made a grant for the undertaking of this expedition by Mr. Bingham. The expenditure has been amply justified and amply rewarded by that which he has discovered and brought home.

WHAT GEOGRAPHIC DISCOVERIES REMAIN FOR THE EXPLORER?

I remember, on one of the previous occasions when I had the honor of addressing you, observing that those of us who care for geographical science seemed to lie under the danger of having, sooner or later, our theme exhausted. We have not yet found a means for the exploring of any other part of this universe except our own planet. With our planet so limited in its area, and now rendered so comparatively accessible in every part, with its population growing so fast, and the number of its explorers increasing, it is natural to believe that before very long there will be no great discoveries left to make. Certainly no discoveries remain to be made so striking as these which have been made of the two poles.

We may, however, comfort ourselves by reflecting that there is another kind of work to be done, and the work which Professor Bingham has done seems to me to show how large that work is and how full of interest and instruction it may be made. Professor Bingham has taken a region which has been known, more or less, since the time of the Spanish Conquest, in the middle of the 16th century; but he has revealed immense fields of further inquiry, which had not been little thought of until he went there.

Has not the time come when we may apply to geography what may be called, in the language of agriculture, "intensive cultivation," when we may begin to bestow upon the surface of our planet a study so full, so exact, so carefully scientific, that we shall examine every part of it from the point of view of the various sciences and from the point of view of the events that have happened since man found him strong enough to deal with and overcome nature. Orography, geology, botany, meteorology, zoology—all these sciences are the handmaids of geography.

THE OBSOLETE TERM, "MAN"

In the largest sense of the word, they may all be called branches of geographic science, which is nothing less than the whole knowledge of our globe, and which is to be worked out by study applied in these various departments. That is to be supplemented also by a study of history of what man has done in these parts of the world where nature permitted him to settle and thrive. So you may say geography is the meeting point of all these sciences, a great stream into which they all pour their tributary brooks. Geography tells us what Nature has offered to Man and what Man has made of Nature.

Possibly I should apologize for using the perhaps obsolete term "man," considering that some of your Western States, following in the wake of Australia and New Zealand, have recently transferred the political, as well as the social scepter from man to woman, and especially considering the fact that this victory is going to be celebrated in Washington upon the third of March by a procession. I will therefore withdraw the obnoxious term and say "human nature."

MR. BRYCE'S FAREWELL

Ladies and gentlemen, I reflect, with sadness, that this is probably the last occasion on which I shall have the pleasure of meeting you here—at any rate, as the representative of my country. I wish to take this opportunity, in saying farewell, of thanking the National Geographic Society for its constant invitations to my wife and myself, and not only for the hospitality we have received from you, which we have warmly appreciated, but also for that welcome which doubles the value of your hospitality.

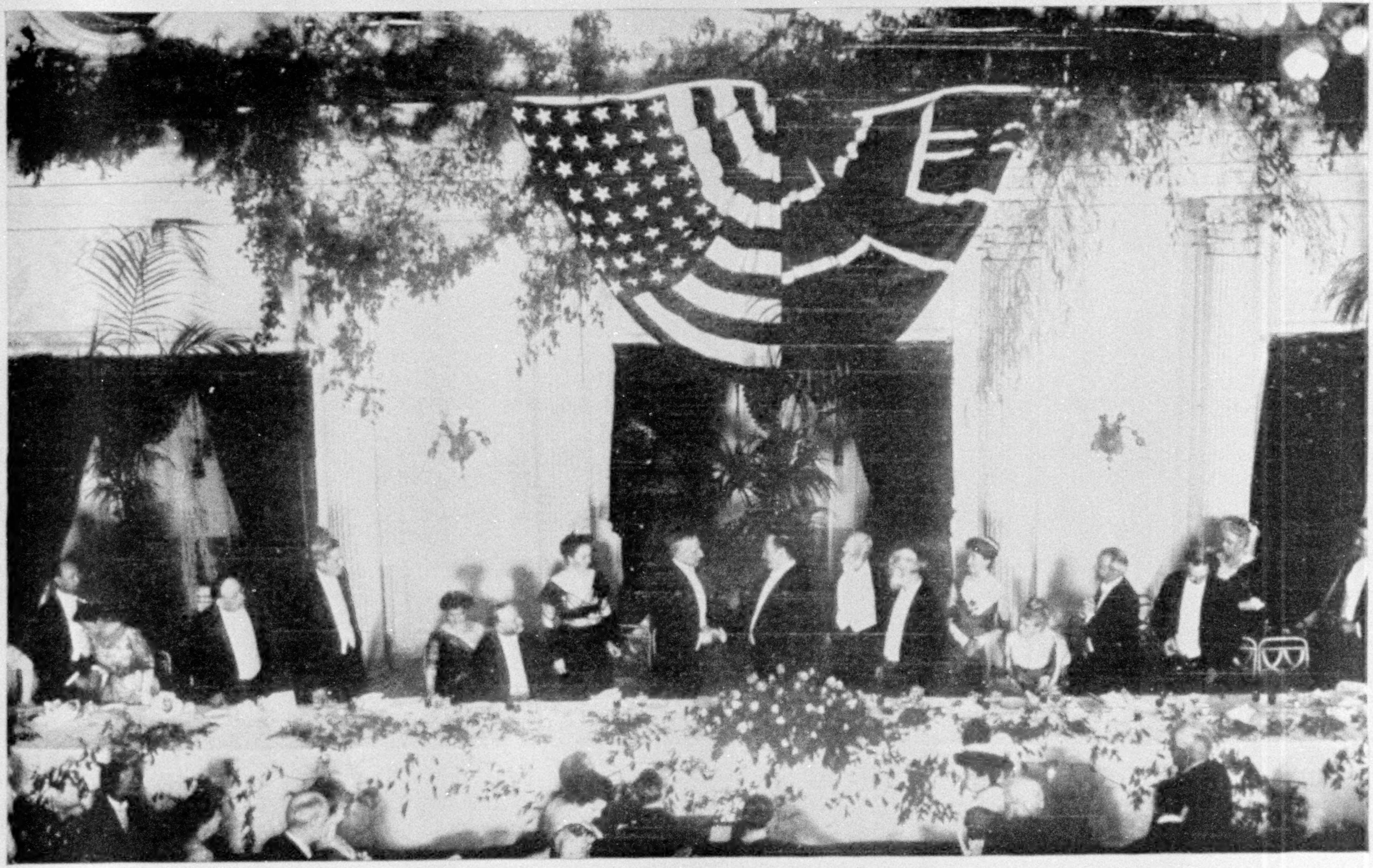
Among all the pleasant gatherings which we have been privileged to attend in Washington, among all the friends whose constant kindness we gratefully acknowledge, here and elsewhere through your country, there are no gatherings which we shall look back upon with more pleasure and with a more grateful memory than those of the National Geographic Society. Here we have rejoiced to meet many who were interested in the same subject, who were alive to all the movements of the world and were eager to help them forward. Here we have always noted and been impressed by the feeling which has pervaded your gatherings, that all nations and all men of science and learning ought to be united by ties of sympathy and mutual helpfulness in endeavoring to advance science and learning and to promote also the peace and good understanding between nations which ought always to go therewith. To be present at such gatherings as this has been to us a constant pleasure. We shall always remember them, and we venture to hope, ladies and gentlemen, that sometimes you will remember those friends who have left you to recross the Atlantic and who will never forget you.

May I express my wish for the continued growth, prosperity, and usefulness of this Society, which in so short a time has attained a position of such prominence among the geographic societies of the world, in its numbers as well as in its activity. It is the hope of all your English fellow-workers that for centuries to come the members of your Society may still find something fresh to do, and that their zeal and earnestness may know no weariness or abatement.

THE TOASTMASTER, ROBERT E. PEARY

I voice the thought of every one in this room when I say I sincerely hope that Ambassador Bryce's prophecy may not come true, but on the contrary we shall many more times have the pleasure of welcoming him and Mrs. Bryce here at the meetings of the National Geographic Society. Comments upon Ambassador Bryce's remarks are impossible and superfluous. Diplomat, student of people and countries, whenever he speaks the fullest measure of pleasure and instruction goes to his hearers.

Our next speaker is a successful man of business affairs, one of our prominent legislators, a man who has felt and seen and believes in the extension of geographic instruction. Whatever he may have to say upon this subject of the need of geographic knowledge will be well worth our consideration. I have the pleasure of introducing to you Hon. William C. Redfield, of New York.



ADMIRAL PEARY, DISCOVERER OF THE NORTH POLE, PRESENTING TO ROALD AMUNDSEN, DISCOVERER OF THE SOUTH POLE, THE SPECIAL GOLD MEDAL OF THE NATIONAL GEOGRAPHIC SOCIETY, JANUARY 11, 1913

The others in the group at the table, beginning on the extreme left, are: The Chinese Minister, Mr. Chang Yin Tang; Madame Chang; the Bolivian Minister, Señor Don Ignacio Calderon; Hiram Bingham; Mrs. Robert E. Peary; Representative William C. Redfield; Mrs. Walter L. Fisher; Roald Amundsen; Robert E. Peary; the British Ambassador, James Bryce; Henry Gannett, President National Geographic Society; Madame Jusserand; Mrs. Bryce; the French Ambassador, J. J. Jusserand; the Secretary of the Interior, Walter L. Fisher; Mrs. William C. Redfield; the Minister from Norway, Mr. H. H. Bryn.

MR. REDFIELD, ON THE NEED OF GEOGRAPHICAL TEACHING

Mr. President, Mr. Toastmaster, ladies and gentlemen: If we may follow the geographical parallel, the position in which I find myself this evening is that of the English Channel, which separates Great Britain from France. It has a somewhat unsavory reputation, but I venture to hope it may not add tonight to the evils which it has visited heretofore upon suffering humanity.

I am but a voice this evening to mention a need and to offer a suggestion, neither more nor less. It is somewhat embarrassing, when one has tried faithfully to teach a working force of supposedly intelligent young Americans something as to where some places are on this globe, to be told by one of them, in answer to a question, "Where is Jamaica?" that it is an American island in the Pacific Ocean. It is almost as bad to be told in Manila that a large Boston firm wrote to a house there on the 8th of June demanding payment of an account, and wrote again on the 25th of June wondering why they had not received a response. It is also equally bad to be told that a large New York concern referred an actual inquiry from Panama to its agent in the Philippine Islands.

I have, unfortunately, been obliged to make an effort to employ young American men and women who were supposed to have some elementary knowledge of geography. I have never found it possible to get one with those qualifications. I think that statement, if you mean by "elementary" the fact that there are continents, is not correct, but if it means any sort of useful knowledge that was available at call as to where the important countries and cities of the world were, I believe it is correct. That is to say, if you attempt to employ young people of from 16 to 25 years of age at any pay running from $10 to $20 a week, you will not find it practicable to obtain from any of them a ready, ordinary common knowledge of the chief cities of the globe. I think that statement is well within the fact.

I doubt very much if a graduating class in our universities could answer correctly 20 out of 25 rather ordinary geographical questions. For example, let us take a practical illustration out of every-day office life.

THE LACK OF GEOGRAPHIC KNOWLEDGE IN COMMERCE

A shipment of machinery is to go to the town of Bandoeng, in the center of Java, and we will call our clerk or tell our stenographer to find out whether this shipment should go by way of Rotterdam and by Dutch steamer to Batavia and thence by rail, or whether it should go to London and thence by P. and O. steamer to Colombo and then via Singapore to Batavia and thence by rail, or whether it should go west by way of San Francisco and Manila and Hongkong, on a chance of catching the steamer for Soerabaja or Semarang and by rail from either point.

I imagine, Mr. Toastmaster, that some of them are caught now, and yet, ladies and gentlemen, with the exception of Bandoeng, there is not one place mentioned that is not a large seaport of prime commercial importance. Not one of those cities but has daily in its harbor many large commercial vessels. There is not one of the towns mentioned with which this country is not in daily, if not hourly, communication by mail and wire, and the statements I have made are taken from facts out of the ordinary commonplace work of a business office.

Our clerks do not know, and there is no place in America today where our young people can get the thorough teaching that will give them a working knowledge of where these places are.

Every day young women as stenographers and young men as clerks are called upon for this knowledge, and their employers are keeping kindergartens to instruct them because the schools do not. It is not the fault of our young people, but their misfortune.

That is a very plain statement of a commonplace fact that every business man who is engaged in foreign commerce knows all about. It is a very serious handicap.

XUM

HOW TO REMEDY IT

The suggestion is this: Cannot this Society, in some way, learn the facts as to the ignorance of the average American young man and woman on the subject of geography? Secondly, having learned them, cannot this Society, in some way, standardize, or attempt to standardize, geographical teaching?

I can say for one very large organization of business houses that if young men or women were to apply to any of the 150 concerns therein represented, bearing some sort of a certificate that the school in which they had learned geography conformed to the standards set by the National Geographic Society, employment would be quicker for these people and wages would be higher. I make the suggestion that something of this kind may possibly, in time, be started, because another scientific society, finding a similar state of ignorance in another line, is now attempting to formulate some standard of instruction that will be country-wide. At the present time, however, our school-taught young men and women of 18 and 20 years of age do not know practically enough geography to trust themselves out at night alone.

THE TOASTMASTER, ROBERT E. PEARY

There is certainly much need for thought in Representative Redfield's remarks. If I might venture, I would suggest that if Mr. Redfield and others would be willing to utilize their commanding positions to assist this Society in the construction, either here or in New York, of a great globe on a scale of 1 to 1 million—which is a scale advocated by representative national geographic congresses for a universal wayof the world—that such globe would enable the business men, the traveler, the student, and the school children to keep in touch with the big as well as the small details of geographical information, which information could be transferred to this globe from time to time as secured over the world, thereby making the globe continuously up to date. An hour or two of visual work on such a globe as that would count for more than days of reading of geographical books.

Across the water there is a sunny land—the birthplace of the automobile, the leader of the world in aviation today, a country in the front rank of every sphere of human activity. The sons of that country have written French names within the Arctic and the Antarctic.

The last of these, Jean Baptiste Etienne Auguste Charcot, the National Geographic Society has elected an honorary member in recognition of his splendid researches and explorations in the south polar regions. The certificate of his election will be received for him by another illustrious Frenchman, also our friend and long acquaintance, His Excellency Monsieur J. J. Jusserand, the French Ambassador.

ADDRESS BY THE FRENCH AMBASSADOR, MR. JUSSERAND

Though prevented from being present at the comestible part in tonight's ceremony, I greatly desired not to miss it altogether, not only because I was sure Admiral Peary would speak with his wonted forceful eloquence, but because I have made it a rule ever to be present when Captain Amundsen is honored for having discovered a pole.

Five years ago we celebrated together the deeds of this Viking's son and of his good ship, *Gjoa*, with which he had, shortly before, ascertained the exact position of the north magnetic pole, and seconded by a crew of six men had, first of all sailors in the world, navigated that northwest passage vainly attempted by innumerable predecessors, from the 16th century to our time.

Like the present occasion, that one was brilliant and memorable, and I am not the only person in this assembly who was there and still cherishes its remembrance. The members of the National Geographic Society were present in imposing numbers; at different tables several explorers of fame were seated; pointing to one of them, a neighbor of mine at table said: "You see that gentleman with the long mustache? Many are making the attempt, but if the North Pole is to be reached by any one, it is he who will do it; he is called Peary." All the world now knows whether my neighbor was or not a good prophet.

A BRANCH OF THE JUJUBE TREE, LOADED WITH FRUIT, GROWING IN CALIFORNIA

American-grown jujubes were first served in the United States at a great public function on the occasion of the Annual Banquet of the National Geographic Society, January 11. These jujubes represented one of the tangible results of agricultural exploration as it is carried on by the Department of Agriculture.

The jujube is one of the five principal fruits of China, and has been cultivated for at least 4,000 years. A Chinese work published 800 years ago listed 43 named varieties; hundreds are described in the more modern works. In China this fruit is highly esteemed, and there are hundreds of varieties, differing in shape, size and flavor. There is even a seedless one and one as large as a hen's egg. Some are eaten fresh and others are candied and dried or used for preserves. The seedless sort is stewed with rice, much as we use raisins.

The jujubes served at the National Geographic Society banquet were grown at the Plant Introduction Garden at Chico, California, and had been candied in syrup and dried. Many of the varieties thus preserved have almost exactly the shape, color, and flavor of dates.

Here, then, is a new fruit as delicious as a choice date and capable of being grown hundreds of miles further north than the date palm. Trees growing in Washington, D. C., were entirely uninjured by temperatures as low as 17 degrees below zero last winter.

XUM

THE ACTIVITIES OF MR. BRYCE

And while others were exerting themselves in far-off lands, most of us Washingtonians were staying at home, anxious for news, but very quiet in this beautiful city. Some exceptions there were, however, one being my British colleague, who was present at the other dinner and is also with us tonight; he did not remain dormant; it is not his fashion. Sure it is that he has in the interval increased the number of his travels, of his books, of his speeches, but not, to all appearances, the number of his years.

Between the dates of the two dinners memorable deeds have been accomplished, causing the unique event which we are going to witness to be possible. Those hands will clasp before us that have planted the flag of their country at the extremities of the world.

We went yesterday to the Masonic Temple, holding tickets in our hands. The carefully devised inscription on them read: "Admit to the South Pole," and we were indeed admitted there. With his clear, plain, straightforward manner of expressing himself, Captain Amundsen truly led us to the pole. We took part in his undertaking, his dog-breeding establishment, his clever preparation, and his long, long journey across unknown solitudes, till at last the goal was reached, Queen Maud's Land was baptized, and Norway's flag planted where no man had set his foot before. The orator spoke calmly; we can scarcely do the same when talking of what he has achieved.

In its kindness the National Geographic Society has desired to associate a French name to the famous ones we are honoring tonight, the name of Dr. Jean Charcot.

THE EARLY FRENCH EXPLORERS IN AMERICA

In the dash to the pole, France, it is true, took no decisive part. There is, however, some dash, I dare say, in my nation, but the kind of discoveries which have ever been the special aim of her sons are the inland ones. While others were exploring coasts we, from the first, have taken a particular pride in assuming the often hard task of exploring the interior of countries. This was conspicuously done on this continent when those singularly bold expeditions of our early explorers took place which are just now the subject of admirable articles by President Finley. The valley of the Mississippi was as a whole first explored by French people, and the names of Chicago, St. Louis, New Orleans first appeared on French maps. The same in Asia with Bonvalot, Dutreuil de Rhins, Pavie, Lefèvre-Pontalis, and all the others; the same in Africa with Foureau, Lamy, Brazza, and their peers.

We did not, however, entirely neglect the polar regions; witness those sailors whose names have just been recalled by that good judge in such matters, Admiral Peary, witness especially the work done before Charcot by Dumont d'Urville, with his tiny frigates, the *Astrolabe* and the *Zélée*, and his visit, toward the end of 1837, to the Great Barrier. As he sailed along he sighted a rift and drove his ship through the narrow chasm, which closed behind him. For five days he was there a prisoner, with no apparent hope for his life and that of his crew, when a lucky storm caused a cleavage in the ice which, with the help of saws and axes, they were able so to increase as to bring the ships safe again to the open sea.

THE FRENCH IN THE ANTARCTIC

On a second expedition, in 1840, he explored vast antarctic regions yet unknown, some still bearing on every map the names he gave them; in particular that of his dearly admired wife, Adélie, the god-mother of *Adélie Land*. On his return, in 1841, he was presented with a medal by our Geographic Society, the same medal which the same society presented the other day to Captain Amundsen in Paris.

Dr. Jean Charcot has proved a worthy successor to Dumont d'Urville, and I offer on his behalf sincere thanks for the way in which you tonight so kindly show your appreciation of what he has done. What he wanted was at all risks to be useful, and he succeeded in perfecting our knowledge of an unknown part of the Antarctic Continent, one not particularly easy to explore. Acting with the earnest desire to help toward a complete survey of an unexplored section, he discarded all idea of duplicating the work of other explorers or of competing with those who, duly prepared for the attempt, were planning their dash to the pole. As testified by your award tonight, by the praise which our chairman has bestowed on him, and by the tokens of appreciation conferred on him by his peers in several countries, he succeeded in what he had planned; our knowledge has been considerably increased, thanks to his exertions, and the fatigues and dangers he and his companions underwent have not been wasted.

DR. CHARCOT'S ACHIEVEMENTS

Owing to his two expeditions, with the *Français* in 1904-1905 and the *Pourquoi Pas* in 1908-1910, presidential names have been added to the royal and imperial ones, recalling almost all Europe and the United States, too, at the southern end of the world. Europe will be more completely duplicated—a quiet, silent, snowbound Europe—now that there is a *Loubet Land* and a *Fallières Land*.

No poles at present remain to be discovered, and the line of coasts of the Southern Continent has been in a great measure explored. What will such men as Shackleton, Charcot, Peary, Amundsen now do? We do not know; perhaps they do not know. Of one thing we are sure—that is, that whatever they attempt will be worthy of their name; whatever it be we wish them success.

THE TOASTMASTER, ROBERT E. PEARY

It has been my good fortune on several occasions and on entirely different subjects to listen to Ambassador Jusserand, and in every case it has been a distinct and emphatic pleasure. His clear-cut diction lifts as the wings of the aëroplane and carries us direct to the point with the directness of the automobile. I wish my friend Charcot could have been here tonight to hear of his magnificent work in the Antarctic regions so ably presented.

We have with us tonight a man who has had experience in both the tropical and the Arctic regions, and I am going to ask him to give us a few remarks upon his experience in those localities. I take pleasure in presenting Mr. Walter L. Fisher, Secretary of the Interior.

SECRETARY FISHER

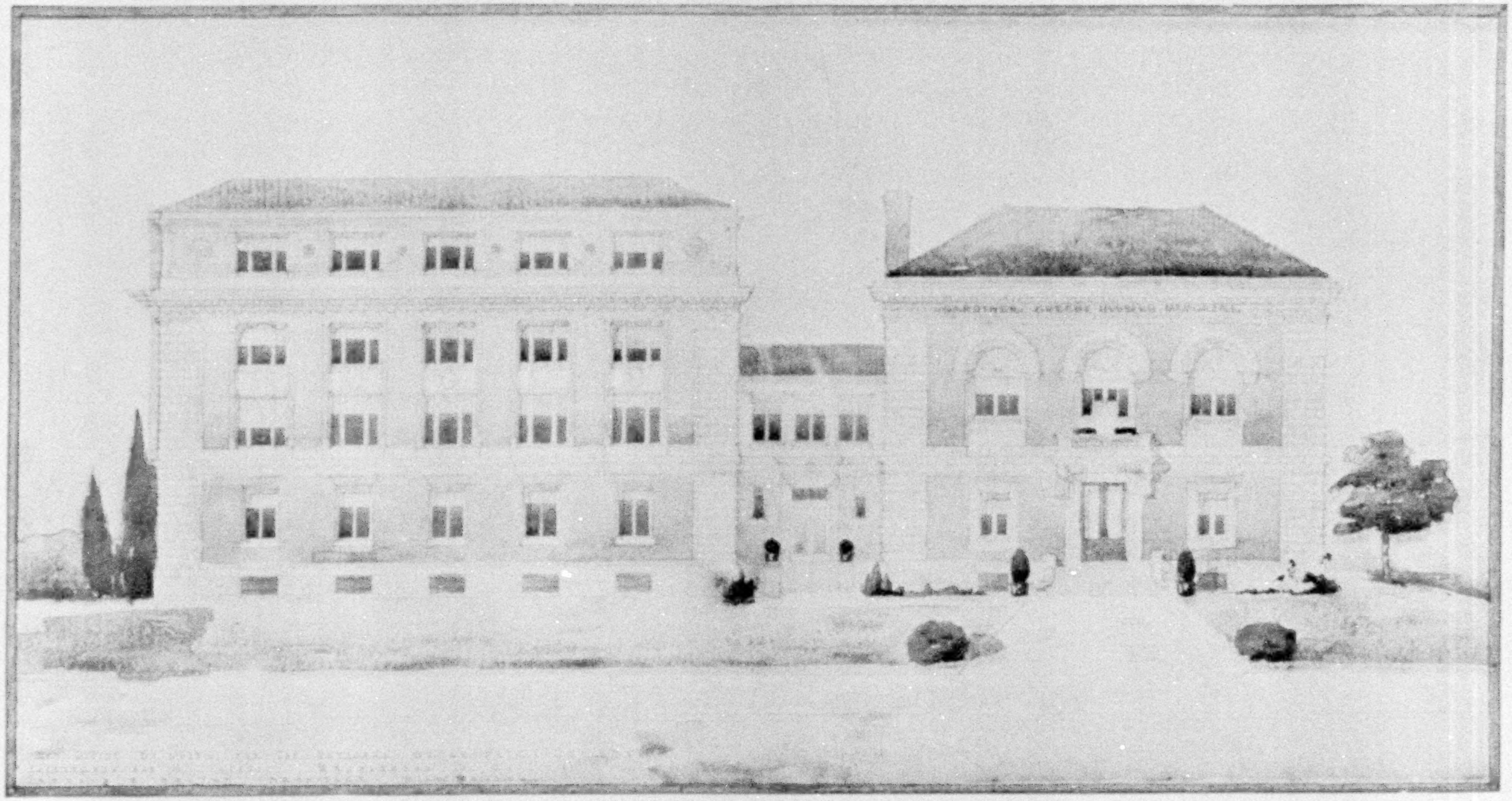
Mr. Toastmaster, ladies and gentlemen: It has been suggested to me that I should say something to you about those far outlying posts of the Department of the Interior in this country, that after all get into the realm of exploration. I have made two very slight voyages of discovery, one to Hawaii and one to Alaska, but on both occasions my object was the investigation of industrial and economic conditions and not of geography.

Of course, I realize that the Department of the Interior has much to do with the subject with which this Society is concerned. A great deal of the geographical work of the United States government is carried on under its direction, the work of the Geological Survey particularly, and in the opening remarks of the President I noted with some interest that this Society has spent some money with some energy upon the recent eruption of a volcano in Alaska.

HAWAII AND ALASKA

The two countries which have been suggested to me have a singular resemblance and singular differences. I do not know whether all of you have thought of the points of resemblance so much as you have of the points of difference; but if for a moment we consider the fact that Alaska is largely volcanic; that it contains some of the few active volcanoes of the world; that it has recently had the most active eruption, we may see one of the resemblances. The volcano which can be best observed for scientific purposes, the volcano which is most accessible and most interesting to the traveler, is that which exists upon the island of Hawaii.

The territories are very different in most respects. I do not know whether I can in this brief notice succeed in repeating to you something that has been written to describe these differences in verse, possibly not intentional in either



THE HOME OF THE NATIONAL GEOGRAPHIC SOCIETY

The building on the right, Hubbard Memorial Hall, was given to the Society for its home by the family of its first President, Gardiner Greene Hubbard. At that time (1903) the Society had 2,000 members. The building on the left is the new office building now under construction and made necessary by the ever-increasing popularity of the Magazine of the Society. The Society now has 170,000 members.

case, and yet if I am able to remember the lines they may carry home some of these distinctive features and may illustrate the different spirit which pervades those far outlying territories of ours.

The island of Hawaii, of course, lies in the tropic or semi-tropic region, and it has a poetess, in the person of the wife of the present Governor of the island, who has written a poem which perhaps describes the sentiment and the atmosphere of those islands better than any other of which I know. It runs something like this:

MY ISLANDS

On the edge of the world my islands lie,
Under the sun-steeped sky,
And their waving palms
Are bounteous alms
To the soul-spent passer-by.

On the edge of the world, dear islands, stay,
Far from clamorous day,
Content with calm,
Hold peace and balm,
Be Isles of the Blest for aye!

The port of the northern clime is of much rougher variety. I do not know how much you know about the country which got its greatest notoriety from the rush to the Klondike. That rush was celebrated in a poem, which has in it vigorous lines like this:

You've read of the trail of Ninety-eight, but
its woe no man can tell;
It was all of a piece and a whole yard wide,
and the name of the brand was "Hell."

But the poem which best describes that land is perhaps the "Spell of the Yukon," written by Robert W. Service.

THE SPELL OF THE YUKON

I wanted the gold and I sought it;
I scrabbled and mucked like a slave.
Was it famine or scurvy—I fought it;
I hurled my youth into a grave.
I wanted the gold and I got it,
Yet somehow life's not what I thought it,
And somehow the gold isn't all.

No, there's the land. (Have you seen it?)
It's the cussedest land that I know,
From the big, dizzy mountains that screen it
To the deep death-like valleys below.
Some say God was tired when He made it;
Some say it's a fine land to shun.
Maybe, but there's some as would trade it
For no land on earth—and I'm one.
There's gold, and it's haunting and haunting;
It's luring me on as of old;
Yet it isn't the gold that I'm wanting
So much as just finding the gold.
It's the great, big, broad land 'way up yonder;
It's the forests where silence has lease;
It's the beauty that thrills me with wonder;
It's the stillness that fills me with peace.

THE TOASTMASTER, ROBERT E. PEARY

In the first chapter of Genesis we read that the Creator, after having first separated the light from the darkness and the earth from the land, filled the land with vegetation and the sea and the air with life, creating man, and said: "Let them have dominion over the earth." Only now, with the attainment of the two uppermost parts of the earth—the North and the South Pole—has that scriptural command become realized.

Today there are, broadly speaking, no large regions on the face of the globe that have not been traversed or penetrated by that incomparable, wonderful, adjustable machine—the human animal—guided by the flame of divine intelligence.

Ended is that splendid series of great ventures and voyages, beginning with the first pushing out of the Phœnician navigators through the Pillars of Hercules into the frightful storms and fearful terrors of the great Atlantic; the crossing of the Equator, where the sun's furnace heat, it was thought, scorched men black; the rounding of the Cape of Good Hope; Columbus' splendid launching into the mysteries of the unknown West; the circumnavigation of the globe; the accomplishment of the Northeast and the Northwest passages; the attainment of the North Pole and the South Pole.

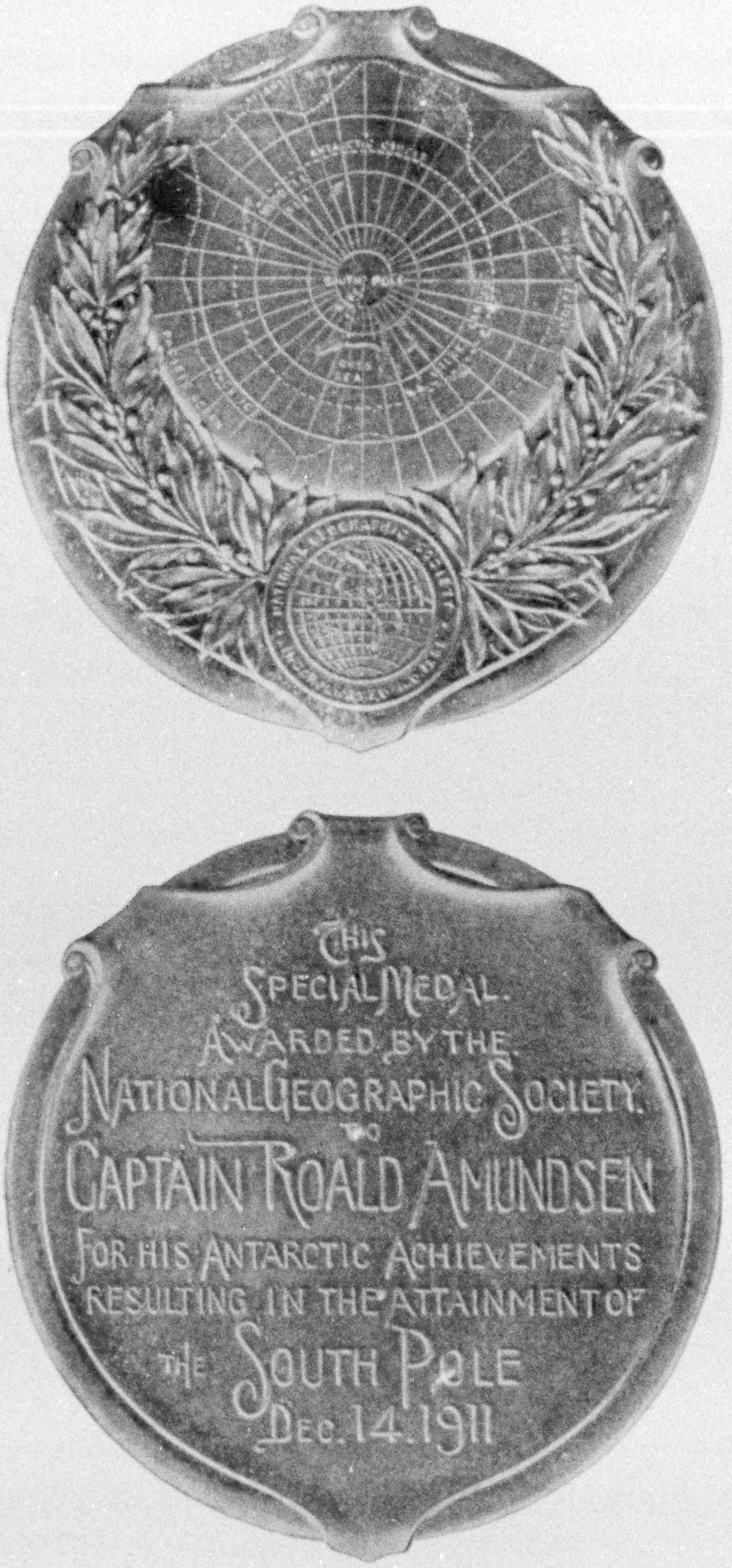
Ended is the long list of strange conceptions of the shape and character of this world of ours.

THE POLAR MYSTERIES VANISH

Vanished are those mysterious regions about the two poles, filled with strange imaginary conditions and peoples.

Gone is the "Open Polar Sea"—"Symnes Hole"—the Garden of Eden; the glistening Lodestone Mountain; the huge ice-cap; the great crater-like basin.

Though every one in this hall tonight knows that the last of the poles has been discovered, I fancy there are some of



THE SPECIAL GOLD MEDAL AWARDED TO ROALD AMUNDSEN BY THE NATIONAL GEOGRAPHIC SOCIETY

you who have not yet grasped clearly the striking contrast in almost every physical condition at those two points. As a matter of fact, the conditions at the two poles are as far apart as the poles themselves.

Yet, though every one of my auditors knows that the last of the poles has been attained, I have no doubt that some of us have not grasped clearly the striking contrast of physical conditions existing at those two points.

Conditions at the two poles are as unlike as the poles are far apart. The North Pole is situated at the center of the hemisphere of the land, yet is itself located in an ocean.

The South Pole is situated at the center of the hemisphere of water, yet is itself located in a continent.

An explorer at the North Pole stands up on the frozen surface of an ocean two miles or more in depth.

An explorer at the South Pole stands on the surface of a great interior snow cap two miles or more *above* sea level.

The most northery North Polar lands possess a comparative abundance of animal life—musk-ox, reindeer, Polar bear, wolf, fox, arctic hare, ermine, lemming, and land birds, as well as forms of insect life—and during a few short weeks in summer numbers of brilliant flowers.

On the Antarctic continent there is absolutely no form of animal or vegetable life, though two or three species of sea birds breed during a few weeks in summer at several localities on the coast.

Human life is found within some 700 miles of the North Pole.

The nearest human life is some 2,000 miles from the South Pole.

Efforts to attain the North Pole have been going on for nearly 400 years.

Efforts to reach the South Pole date back 140 years.

The history of North Polar exploration is studded with crushed and foundering ships and the deaths of hundreds of brave men.

The history of South Polar exploration shows the loss of but one ship and the loss of two or three men.

In *one* respect the two poles are alike.

Their conquest depended, in the last analysis, upon the first primal machine, the most wonderful and adjustable of all—the animal, man, and the Eskimo dog.

THE DISCOVERER OF THE SOUTH POLE

Sitting at this table is a man—look in his eyes and try to imagine to yourselves what those eyes have seen—a man who forced his way across hundreds of miles of icy Antarctic waste; climbed thousands of feet into the frozen Antarctic air, and stood at last more than two miles above sea level, with a frozen desert stretching from his feet to the horizon, and the yellow sun circling parallel with the horizon, at the South Pole—Amundsen, of Norway.

Amundsen, for your "Antarctic explorations, resulting in the attainments of the South Pole," The National Geographic Society has awarded you this special gold medal.

You already hold the Society's other grand prize—the Hubbard gold medal—for your successful forcing of the first ship through the Northwest passage, from the Atlantic to the Pacific, and for your definite re-location of the North Magnetic Pole.

In one respect this medal is unique. Within its yellow circle is crystallized the appreciation of 175,000 intelligent men and women, the members of this Society. In this respect no other trophy you have, or will receive, can equal it.

Health, strength, good luck continue with you.

CAPTAIN AMUNDSEN

Mr. President, Mr. Chairman, ladies and gentlemen: I am not going to try to make a speech here tonight after all these delightful speeches which we have heard delivered from those illustrious and distinguished men here tonight. I am only briefly going to thank the National Geographic Society for the great hospitality and the great kindness which they have shown me this time. This is not the first time. I came here five years ago and I was received when I came as a stranger, but I went away, as I felt, a good, dear friend. I went away with the highest honors from the Society. The feelings I had at that time toward the Society were highly strengthened by the hospitality and the sympathy which it extended to me here.

I certainly appreciate very highly this special gold medal, the highest medal which the Society can bestow upon an explorer. I appreciate it highly, but I also appreciate still more highly the way in which I have been handed this medal. I have been handed this medal, I might say, from the most illustrious of the living polar explorers.

From the time I was a boy I followed Admiral Peary in his work; I was with him when, in 1890, for the first time, he crossed Greenland. I was with him in my thoughts; I was too young to try to follow him, but I have followed him in my thoughts and later in his work. I followed him when inch by inch he worked his way toward the north, inch by inch, foot by foot, and yard by yard until he finally succeeded in planting the Stars and Stripes on the most difficult part of our globe.

I am mighty thankful to you, Admiral Peary, for all the experience and all the assistance you have really given me in my work.

WHY AMUNDSEN SOUGHT THE SOUTH POLE

There is one thing which perhaps not many of you here tonight know, and that is that it was really Admiral Peary who sent me out to the South Pole. I was preparing my trip toward the North Polar regions—it may be to the North Pole—in 1909. It was not very easy to start an expedition from Norway, for it was hard work among us to raise money and I was preparing this expedition slowly.

Then suddenly the news flashed all over the world that the North Pole had been attained; that Admiral Peary had planted the Stars and Stripes up there. The money, which had been scarce, now went down to nothing. I could not get a cent more and I was in the midst of my preparations.

One of the last mysterious points of the globe had been discovered.

The last one still remained undiscovered, and then it was that I took the decision to turn from the north toward the south in order to try to discover this last problem in the polar regions.

So you see it was really Admiral Peary who sent me away. Well, I thank you, Admiral, for that.

I am now going to thank the National Geographic Society for all they have shown me in the way of kindness and hospitality, and permit me, in closing, to wish the Society every prosperity in the future. The President recently told us that the Society at present holds a membership of 175,000, I think the largest by far of the geographic societies in the world. I wish the Society a continued growth, and when I come back from my North Polar Expedition I hope I may find it holding a membership of at least 300,000.

THE TOASTMASTER, ROBERT E. PEARY

I thank you heartily, Captain Amundsen, for your friendly remarks in regard to me.

You have listened to the words of a man who has accomplished a great thing. I need not go into details. You have heard from his own lips the story of how he pitted red blood, tense muscles, and the insistence of the human brain against the cold, the hunger, the fatigue of the Antarctic hell, and won.

The presence of such a man as Amundsen in our midst ought, and I hope will, spur us as individuals, as Societies, and as a nation to take our proper share and part in the great work yet to be done in the Antarctic.

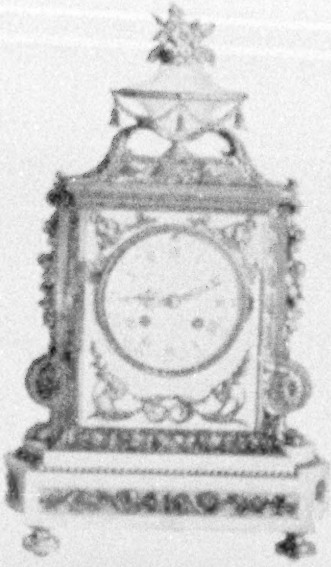
There are two ways in which this country could make up for its past lethargy in Antarctic work and take front rank at once in this attractive field.

One is to establish a station at the South Pole for one year's continuous observations in various fields of scientific investigation.

The other is to inaugurate and carry out in a special ship, with a corps of experts, through a period of several seasons, a complete survey and study of the entire periphery of the Antarctic Continent and its bordering ocean.

We should also set before ourselves the thorough exploration of the region south of Cape Horn, the Weddell Sea region, which is especially within our sphere of influence, together with a traverse from the most southern point of that sea to the South Pole itself.

Such traverse, with the work of Amundsen, of Shackleton, of Scott, would give us a complete cross-section of Antarctica.



This clock, of the period of Louis XVI, is from our exhibit of clocks and candelabra, representing the principal decorative periods.

Many pieces are replicas of treasures now preserved in the museums of Europe, or of famous specimens belonging to the Wallace and Rothschild collections.

Those who desire clocks and candelabra in harmony with classic decorative treatment will find this exhibit notable both in rarity and artistic importance.

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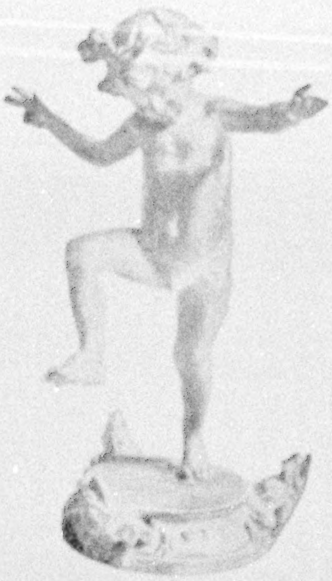

It would be difficult to give happier expression to the play of running water than Miss Jeannette Scudder has given in her charming fountain pictured above.

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Reserve, Re-Insurance (Marine)	437,384.65
Reserve, Unpaid Losses (Fire)	599,559.59
Reserve, Unpaid Losses (Marine)	111,584.00
Other Claims	633,047.79
Net Surplus	**8,238,392.50**
Total Assets	**$23,051,531.36**
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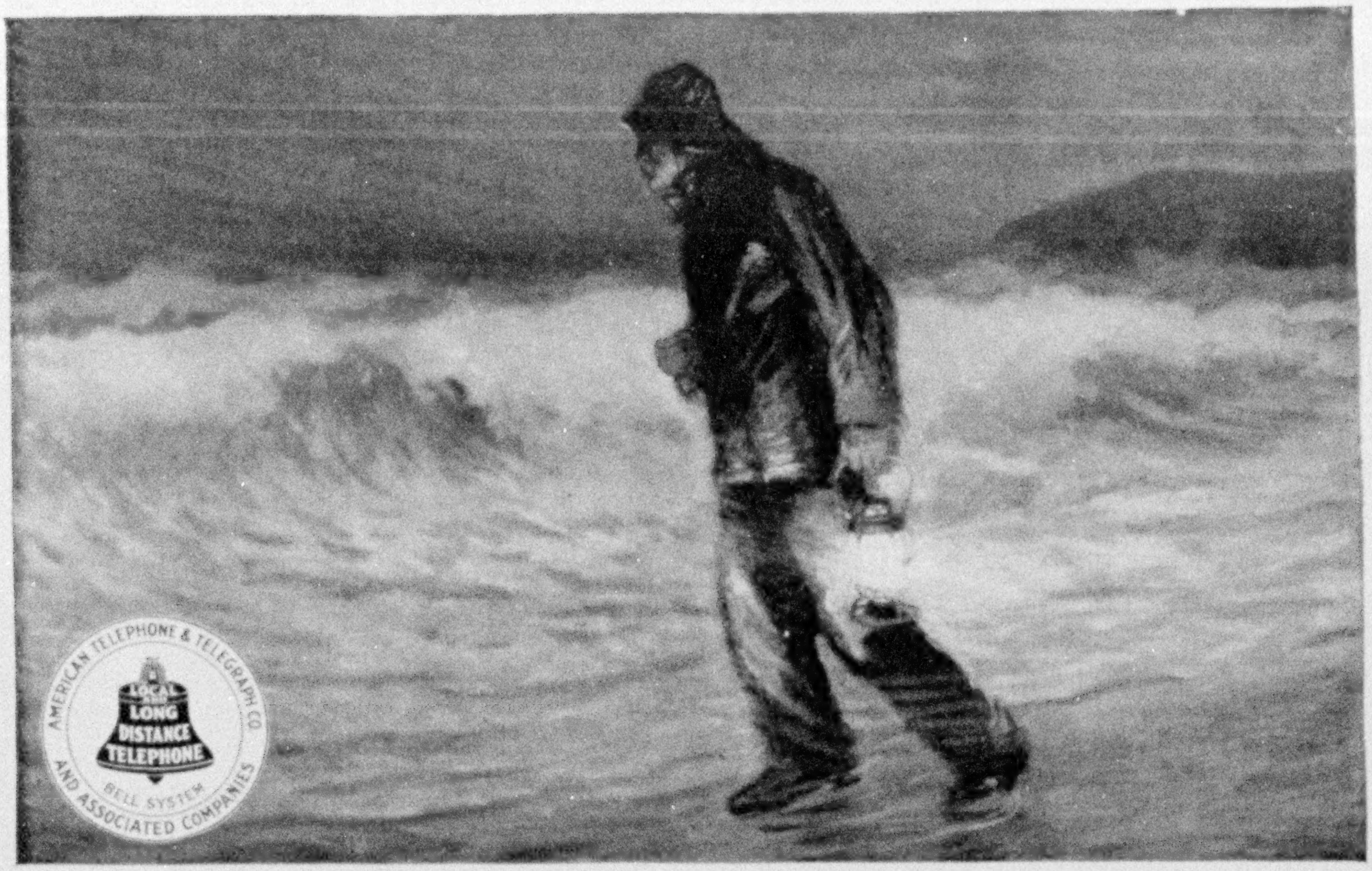

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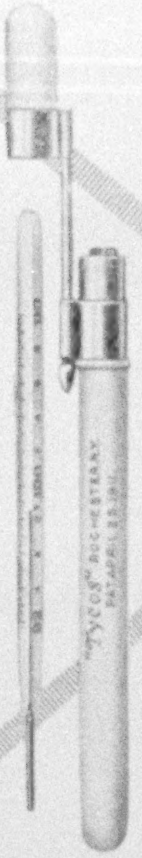
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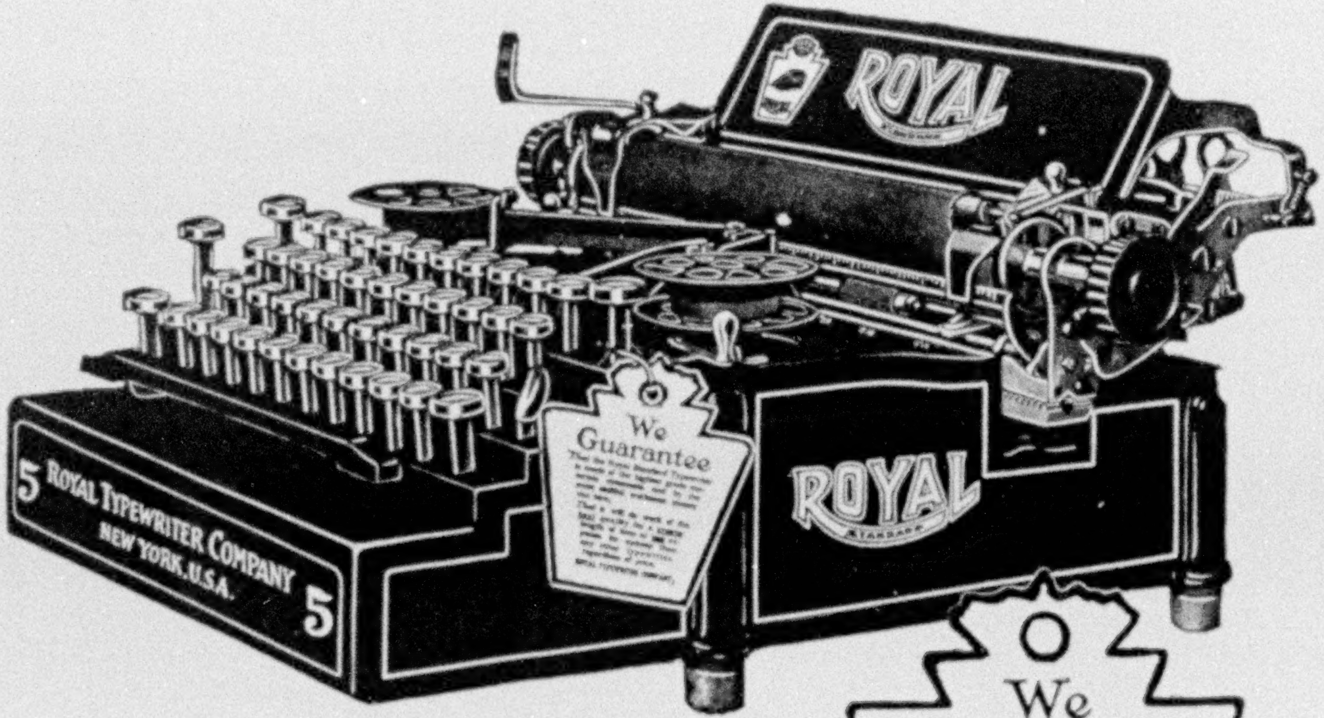
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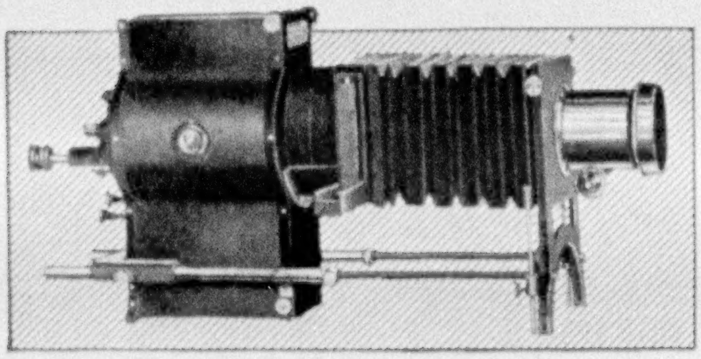

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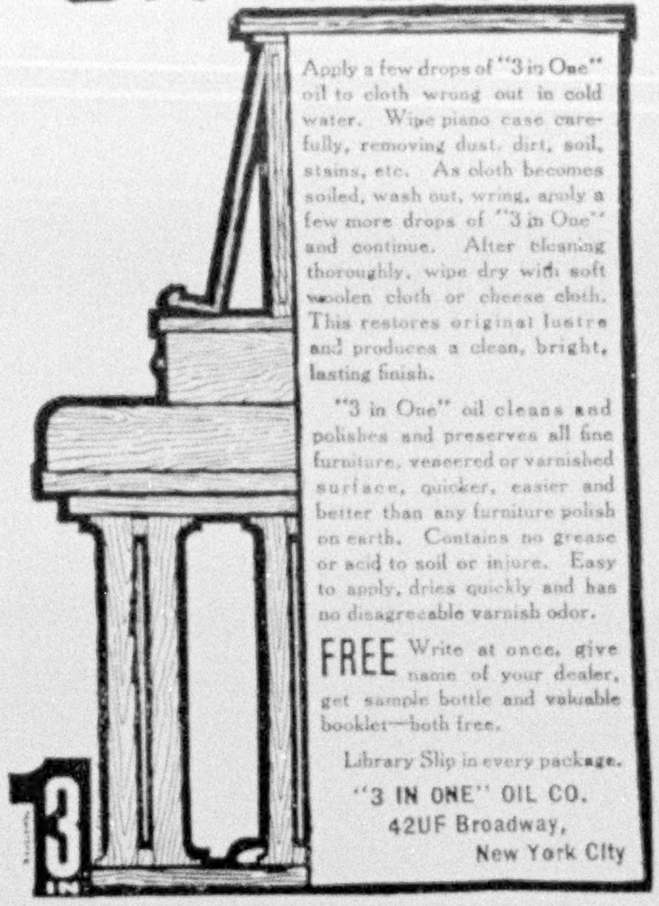

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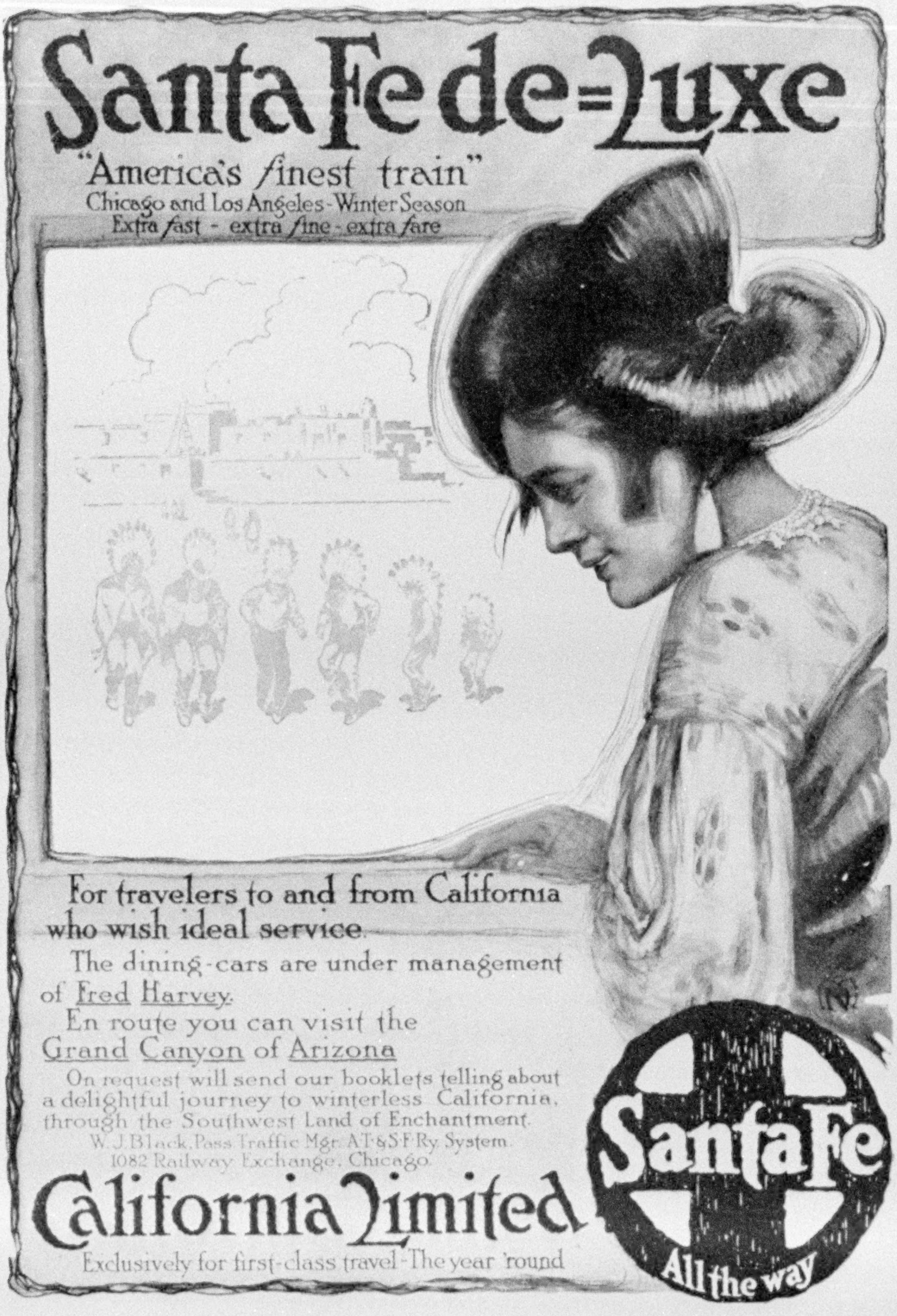

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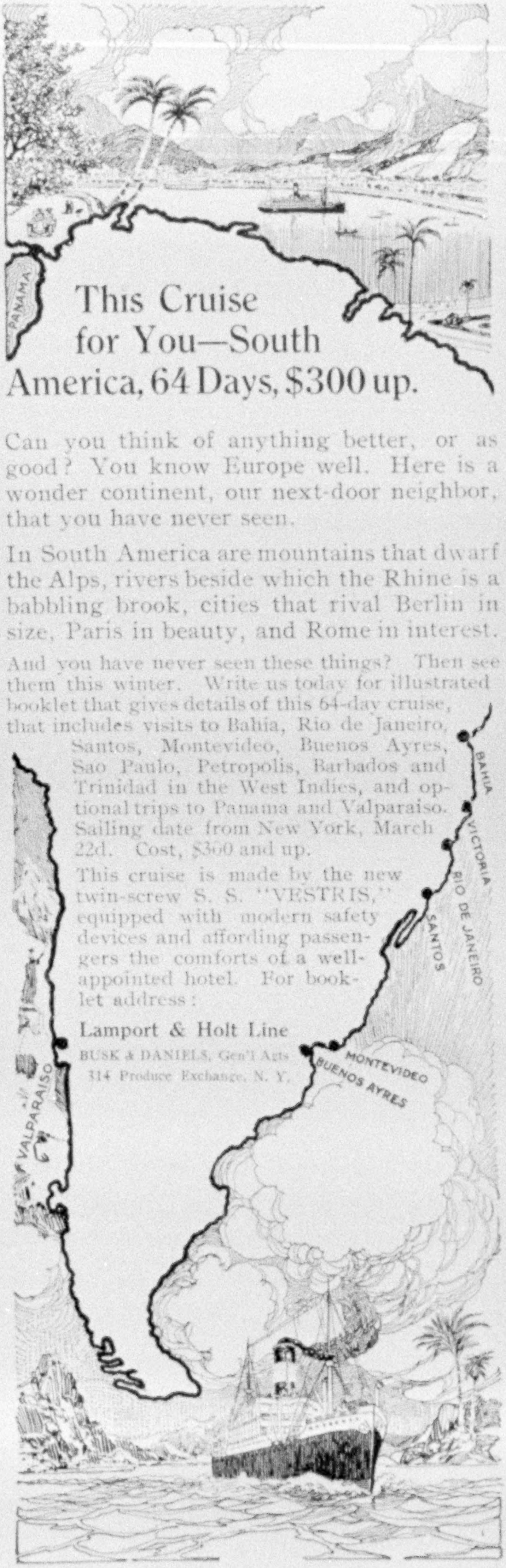

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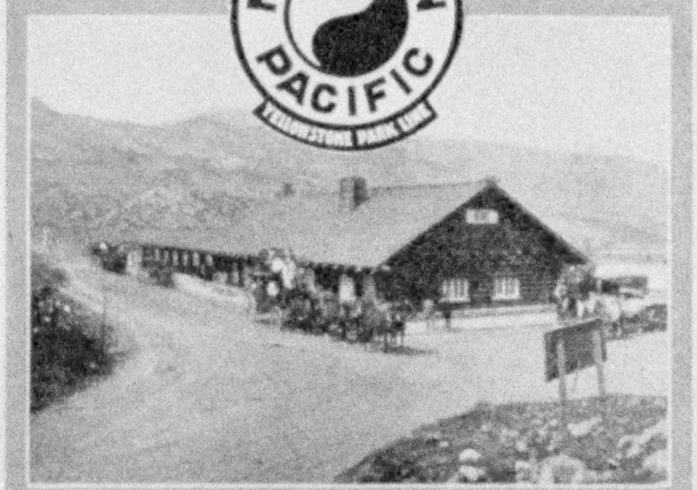

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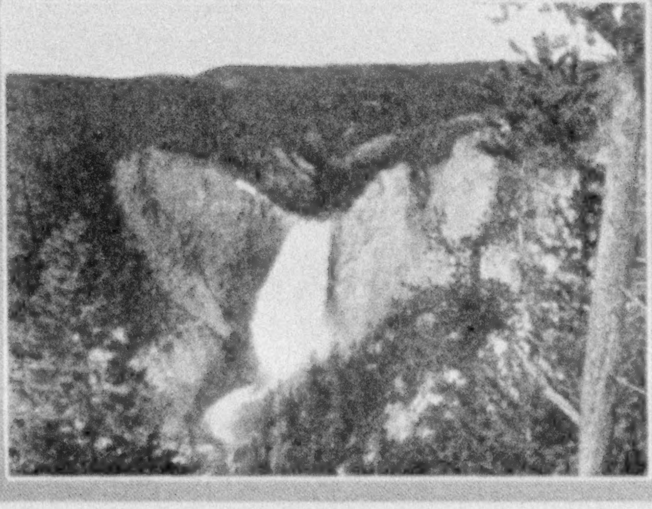

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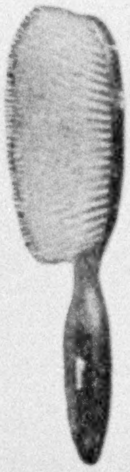

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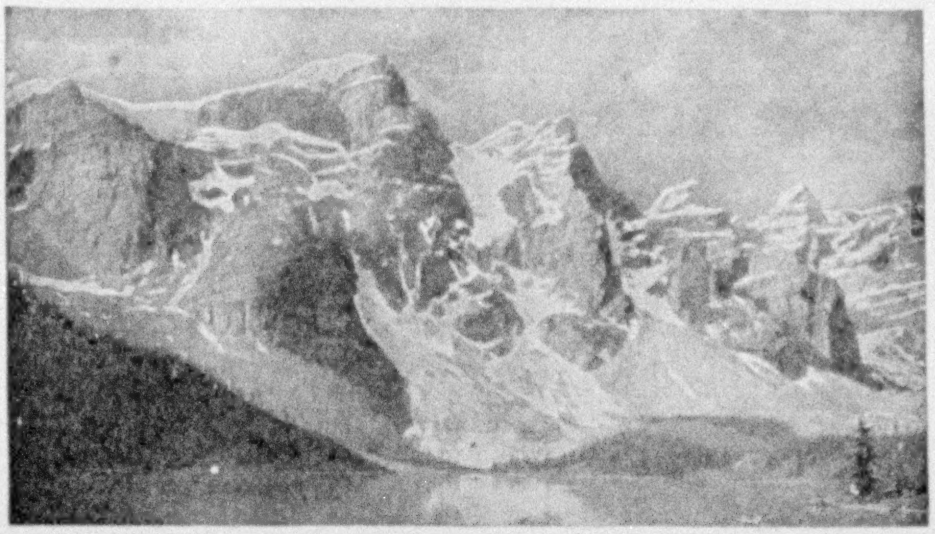

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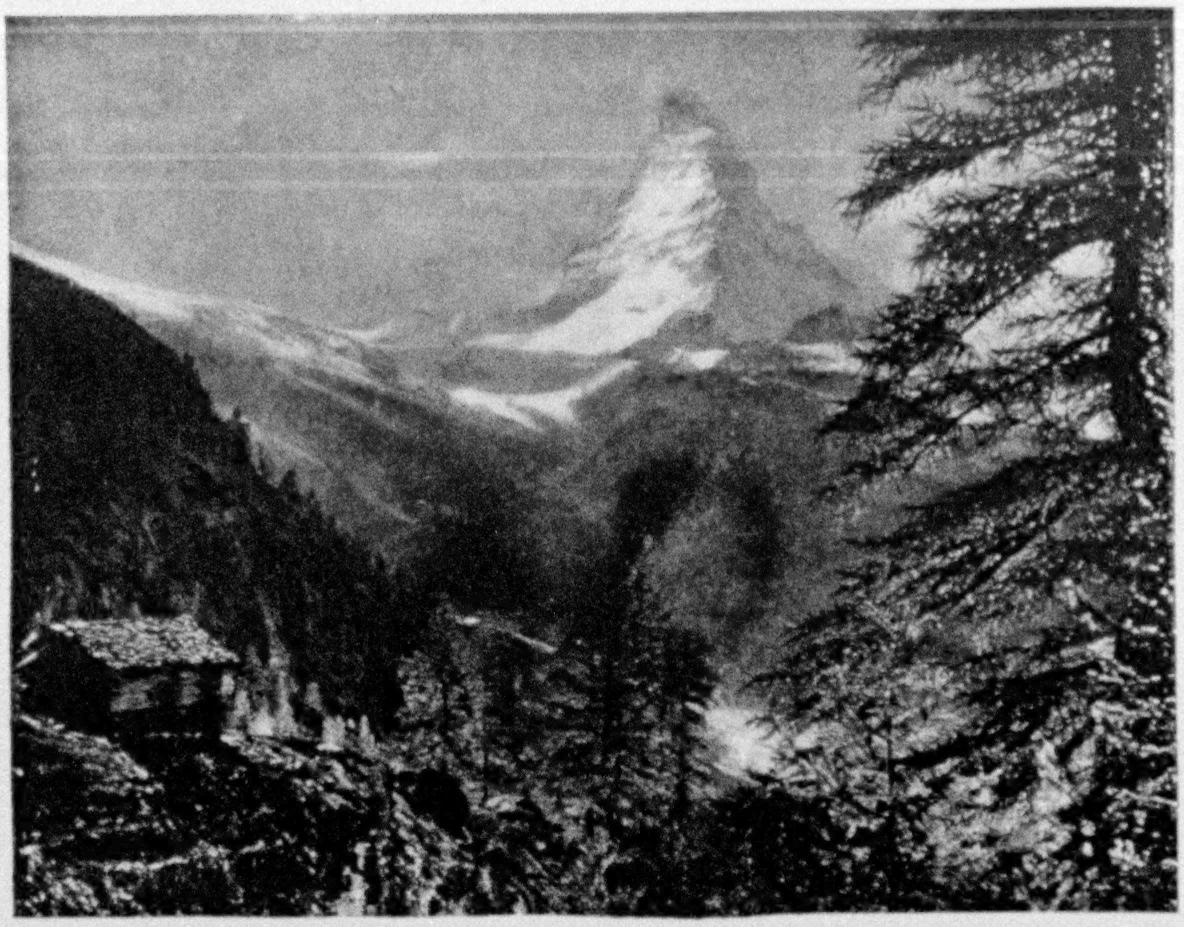

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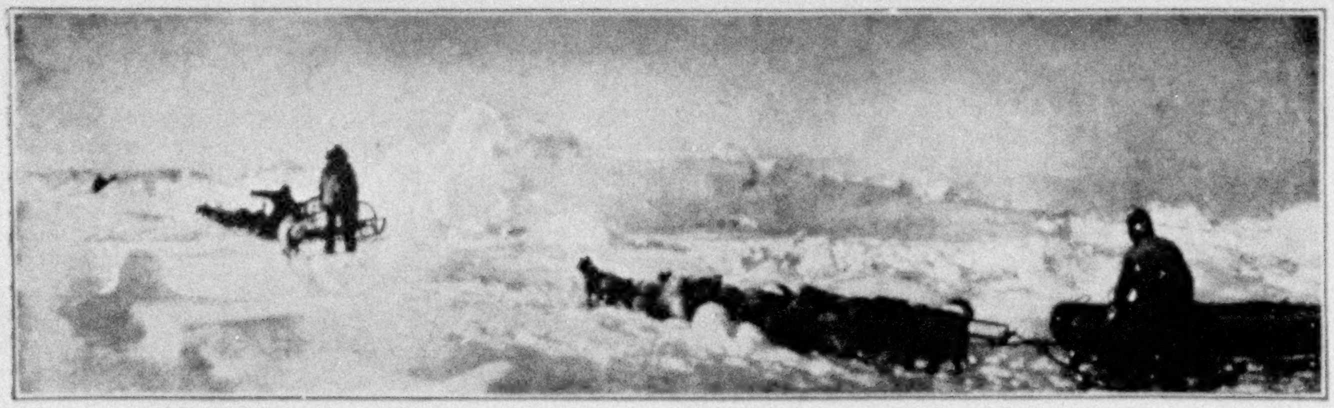

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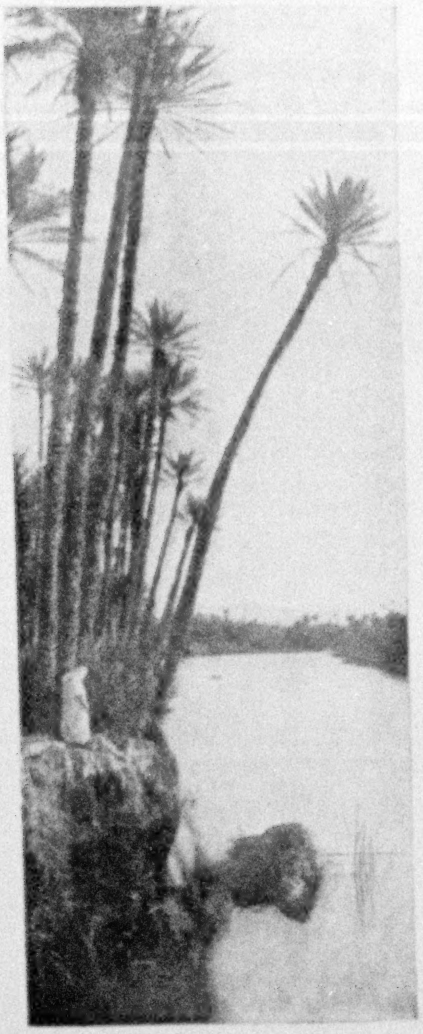

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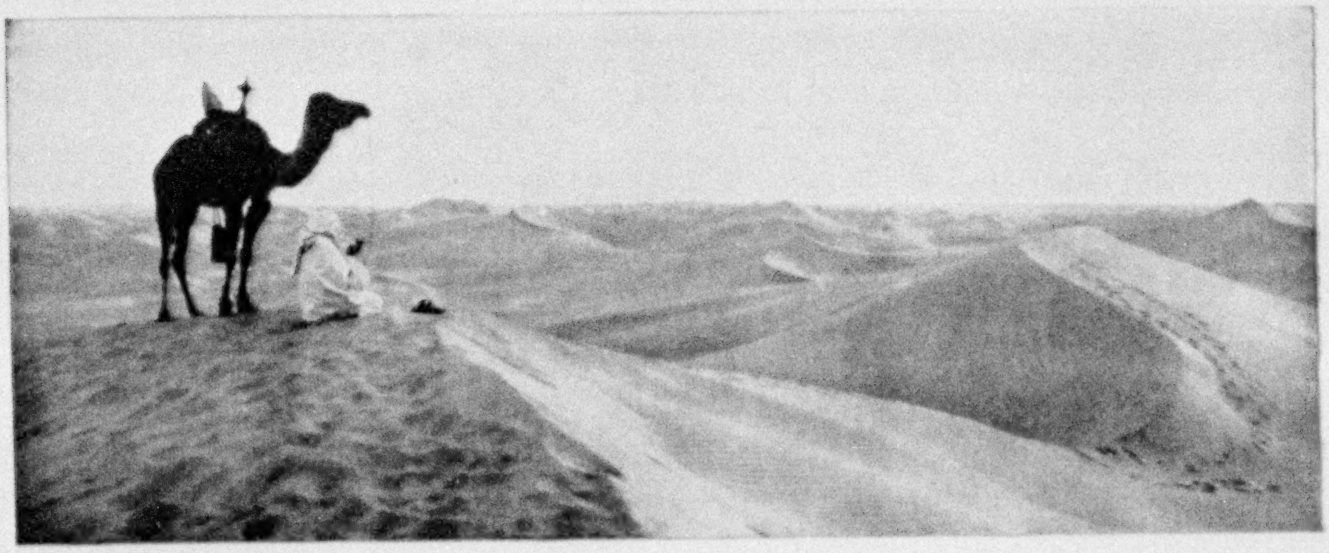

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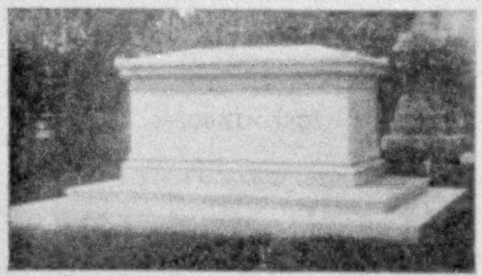

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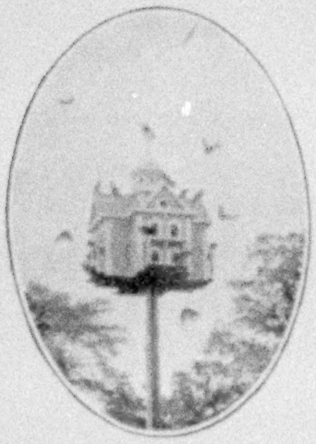

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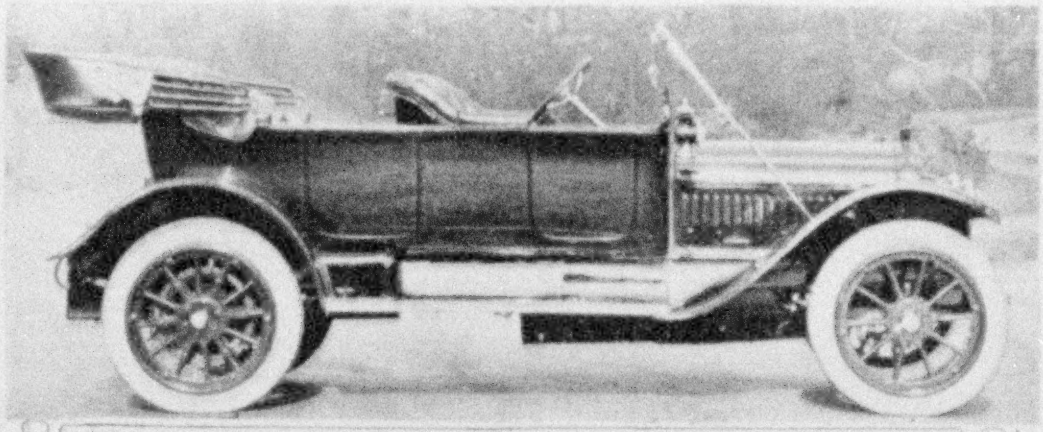

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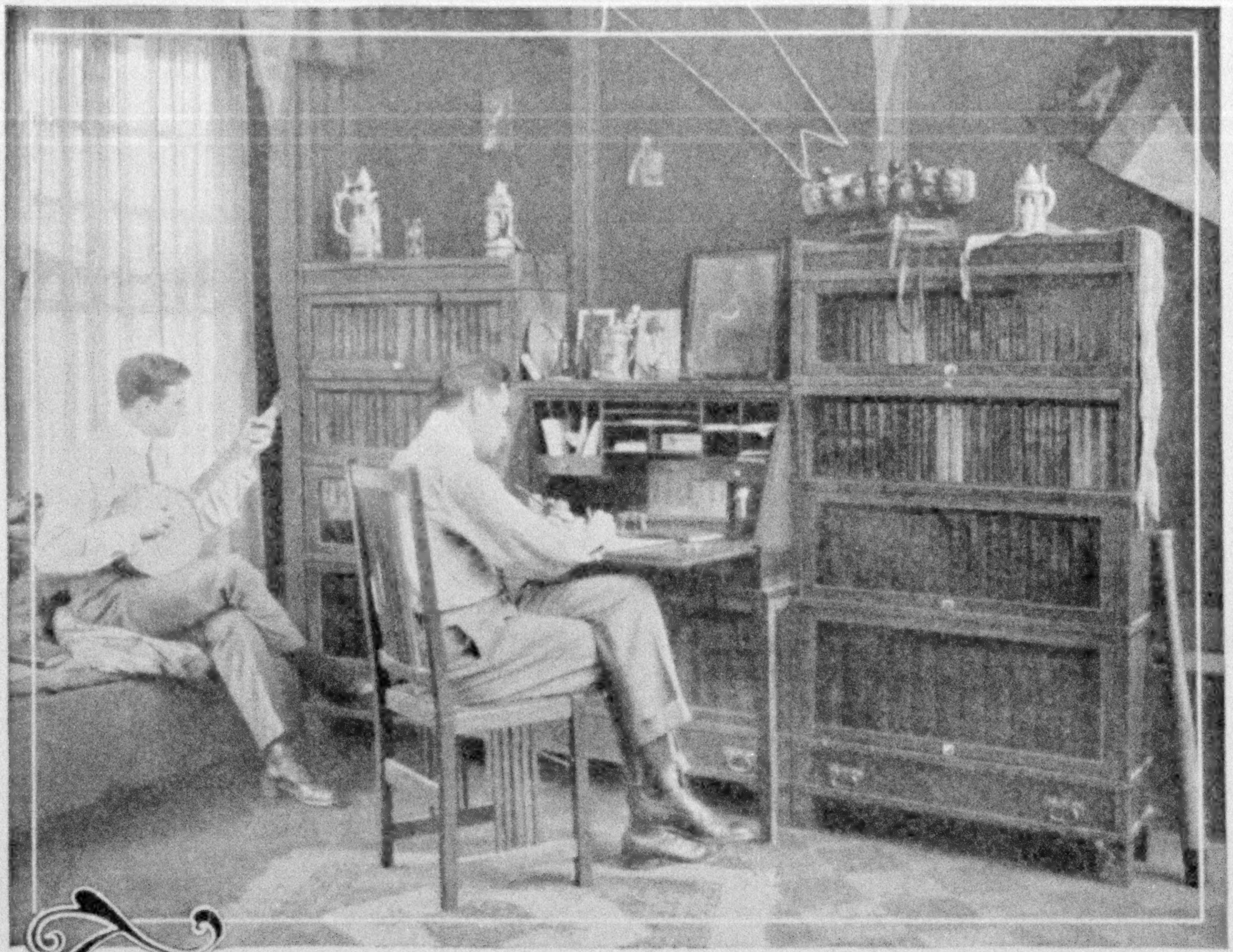

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